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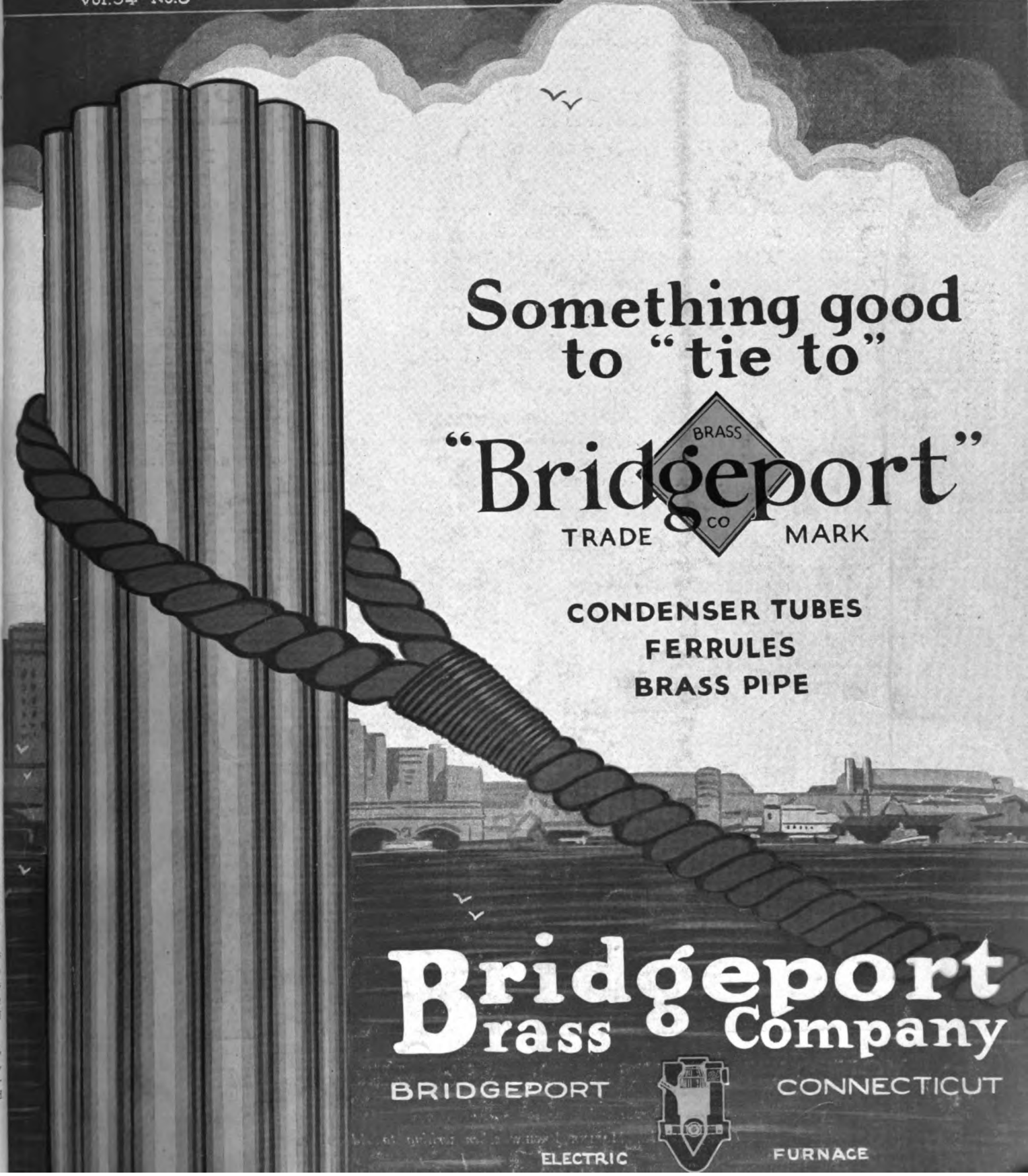

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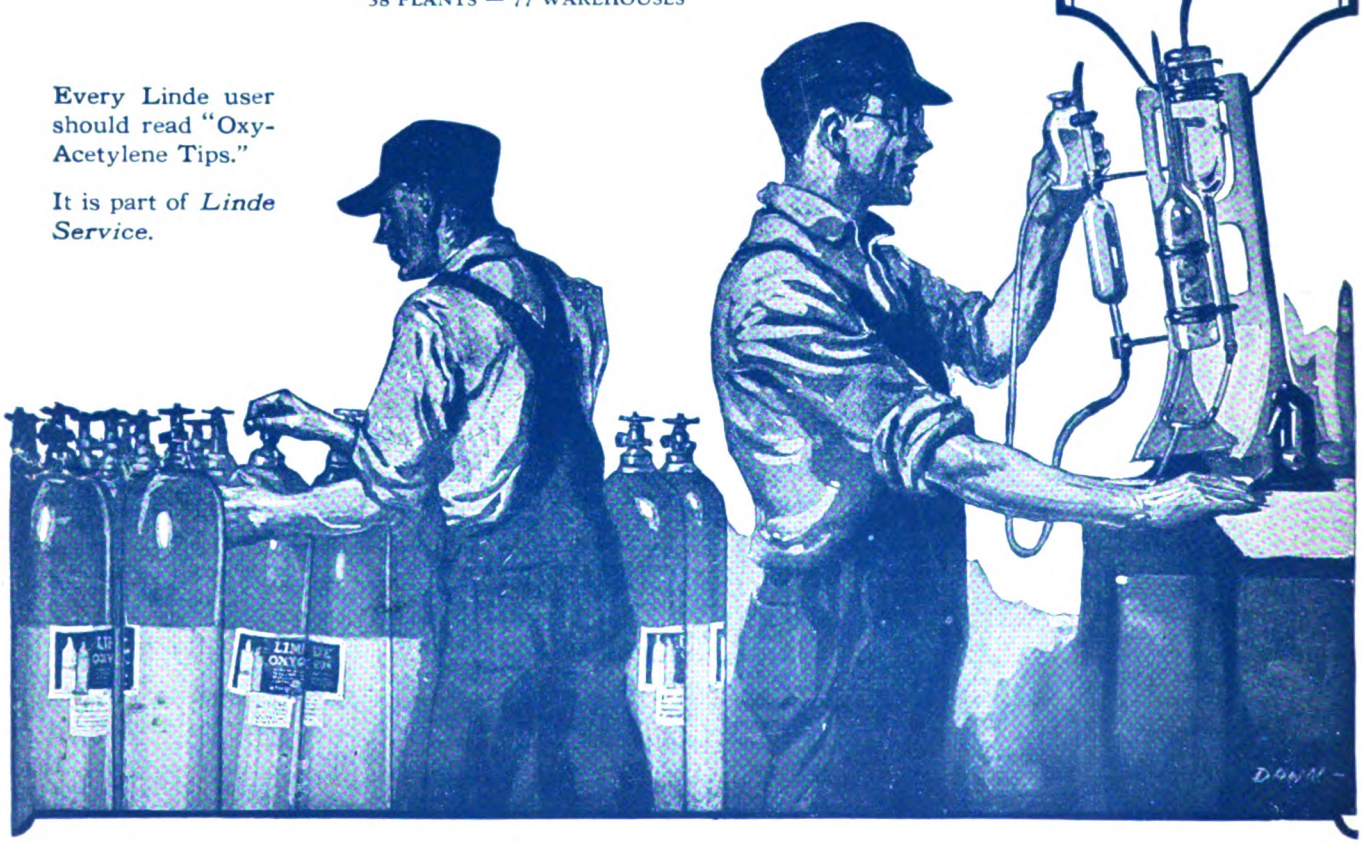

YOU CAN DEPEND ON THE LINDE COMPANY

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Marine Review

Steamer WASHINGTON IRVING of the Hudson Day Line passing Anthony's Nose on the Hudson river. She has the largest passenger capacity of any vessel in the world

Cutting the Fuel Bill in Two

WITH the completion in April of the new side wheel passenger steamboat ALEXANDER HAMILTON, the Hudson River Day line will have a fleet of six ships, four of them oil burners, ready for the summer passenger service on the Hudson river between New York, Albany and intermediate points.

Ever since the experimental trip a century ago of Robert Fulton's CLAREMONT there has been a steady growth of navigation on the Hudson. Of all the agencies engaged in traffic on this wonderful waterway, none is more closely associated with the history of the river or has had a steadier growth than the Hudson River Day line. Nearly one hundred years ago passenger boats plied regularly between New York and Albany and the principal owners and managers of the present service are of the third and fourth generations of a family actively connected with these early efforts.

The Hudson River Day line had its origin in 1863 as the Albany Day line. In 1879, the company was incorporated under its present name. Its fleet in 1863 consisted of two steamers, the DANIEL DREW and the ARMENIA. In 1865, the CHAUNCEY VIBBARD was constructed. Up to 1880, two of the foregoing vessels constituted the fleet. In 1880, the ALBANY was added and in 1893 the NEW YORK. For some time, the steamers ALBANY and NEW YORK supplied the required service. In 1906, the HENDRICK HUDSON was added and in 1909 the ROBERT FULTON, replacing the NEW YORK. Until 1913, the ALBANY, the HENDRICK HUDSON and the ROBERT FULTON comprised the fleet. Then in 1913, a fourth vessel, the WASHINGTON IRVING, was added and in 1921 a fifth the DEWITT CLINTON. With the completion of the ALEXANDER HAMILTON in 1924, the fleet will comprise six vessels. From 1903 to 1917, the company also controlled the operation of the famous MARY POWELL.

Line Carries No Freight

The rapid growth of this fleet in the last 24 years is graphically illustrated by a summary of the total passenger capacity at different periods as follows:

Year	Total Passenger Capacity
1900	4,000
1906	12,000
1909	12,500
1913	18,500
1921	23,500
1924	27,700

A unique feature of the line is that no freight of any kind is carried, the service being confined exclusively to transporting passengers. It is, of course, a seasonal service, beginning about the middle of May and ending in the latter part of October each year.

A daily through service is maintained between New York and Albany beginning at the New York terminus of the line at the foot of Debrosses street, stopping at Forty-second street and 129th street piers and at Yonkers, then express to Newburgh with stops to discharge and take on passengers at several points between Newburgh and Albany. Leaving New York at 9 a.m., the schedule provides for arrival in Albany at 6.30 p.m. This means a steadily maintained average speed of 18 miles per hour, or a little better for 120 miles up the river where the depth of water is ample. There are also regular daily services between New York, Newburgh and intermediate points and between New York, Poughkeepsie and intermediate points. Numerous excursions on the Hudson are also arranged. The accompanying map of the Hudson river shows the route followed and gives distances from New York.

In considering the reasons for the

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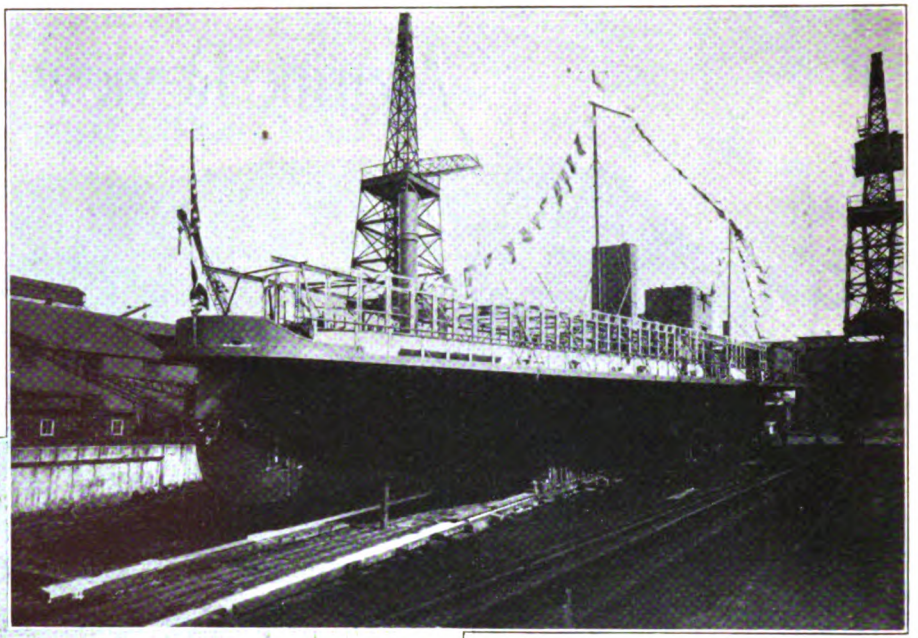
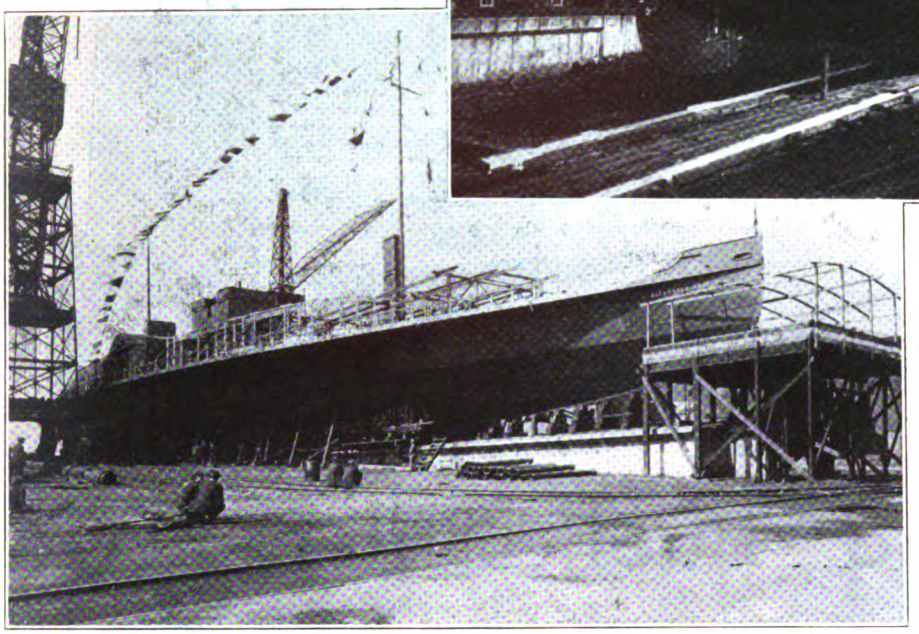
growth and popularity of this passenger service on New York's great waterway, three factors are of primary importance. First, the natural characteristics, scenic beauty and historic associations of the river and its shores and the inherent desire of people to travel by water; second, the rapid increase in population of New York and the country traversed; and third, the quality of the service offered at attractive rates. A glance at the accompanying illustrations will give some idea of the spaciousness, the beauty of line and excellent proportions of the steamers comprising the fleet.





NEW STEAMER ALEXANDER HAMILTON FOR HUDSON RIVER SERVICE READY FOR LAUNCHING AT SPARROWS POINT

The WASHINGTON IRVING has the largest passenger capacity of any vessel in the world on river, lake or ocean. Comparing the WASHINGTON IRVING, the HENDRICK HUDSON and the ROBERT FULTON with the ALBANY it will readily be seen that great progress has been made. The lessons learned through long experience have been carefully applied in new additions to the fleet in order to make them still better adapted for the specialized service required.

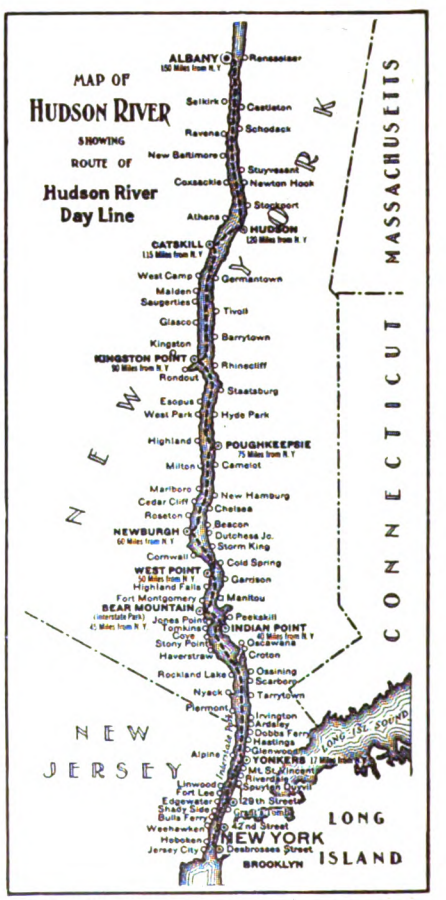
Vessels Kept Up to Date

Liberal appropriations to secure the best quality in new construction, and for modernizing and keeping in first class repair its vessels and equipment, has been the settled policy of the company. Well known naval architects particularly familiar with the type of vessels required, such as Frank E. Kirby and J. W. Millard & Brother, have been retained from time to time to carry out designs for new vessels and the reconditioning of existing vessels. In this work the line's management and staff, with their intimate knowledge of the needs of the service, have closely collaborated in determining the design, arrangements and details in order fully to meet present and future requirements.

Good vessels and attractive vessels are essential to successful operation of a passenger service, but efficiency and courtesy on the part of officers and crew, is surely of like importance, and consequently great care is exercised to maintain the highest standards in the personnel. Certain other conditions also tend to make the service attractive to passengers. For instance, passengers have the complete freedom of wide, open decks and of all other parts of the vessel with the exception of the working spaces. By being exclusively devoted to carrying passengers, not having to bother about freight, and by using an entire deck and several gangways, quick landings and exceptionally rapid discharge of passengers is possible.

Type Most Suitable

From a shipbuilding and engineering point of view the vessels of this fleet are distinctly and completely of American origin. The type has been gradually developed specifically to meet the requirements of the service. Their design has not been affected except in certain refinements and improvments in detail, by the many revolutionary changes in naval architecture and marine engineering for ocean going vessels. The reason for this apparent conservatism is simply that the type fixed upon many years ago has proved to be the most suitable. Four of the present five vessels of the fleet are side paddle wheel steam-



TERRITORY SERVED BY EXPRESS STEAMERS BETWEEN NEW YORK AND ALBANY

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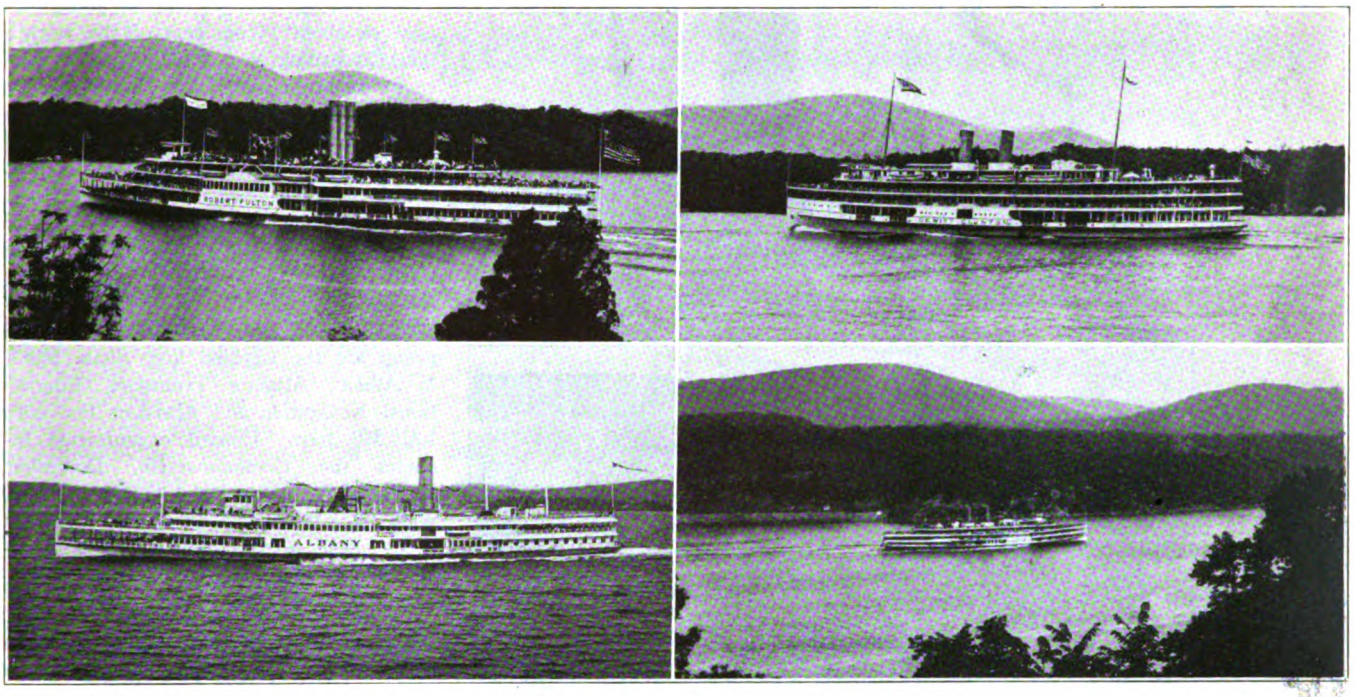


FOUR STEAMERS OF THE NEW YORK-ALBANY ROUTE. ABOVE, LEFT TO RIGHT, ROBERT FULTON AND DEWITT CLINTON. BELOW, LEFT TO RIGHT, ALBANY AND HENDRICK HUDSON

ers and so is also the new ALEXANDER HAMILTON. The DEWITT CLINTON is the only one of the fleet that is screw propelled, but this vessel was acquired after having been built originally for a different service. For the paddle steamer the engines are either the beam type or diagonally inclined 3 cylinder compound or triple expansion. Experience indicates that paddle wheel propulsion is most suitable, everything considered, for passenger navigation on the Hudson particularly on account of the greater ease of maneuvering in shallow water in making the necessarily frequent landings.

Conversion to Burn Oil

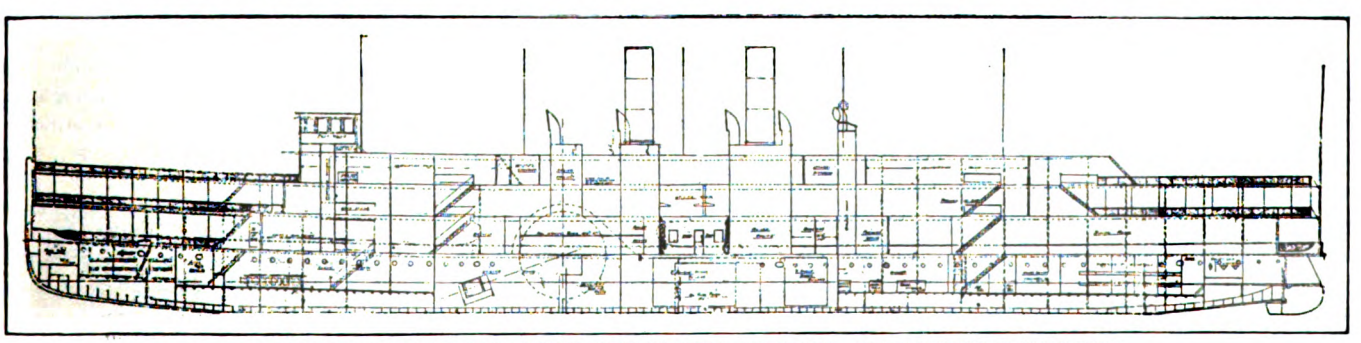
Until the fall of 1922, all of the vessels of the line were coal burners. It was then decided to convert the DEWITT CLINTON to an oil burner, using the Peabody Engineering Corp. type of wide range mechanical burner. The results surpassed all expectations. According to the management of the line, fuel costs per mile were reduced from $4.00 to $2.27. A part of this saving was no doubt due to a direct improvement in boiler efficiency by certain changes in the Howden fronts when the air registers for the oil burners were installed. Some saving is also due to the elimination of the wasteful process of cleaning fires.

A considerable part of the saving, however, is attributed to the complete control of steam pressure. At the frequent slowdowns and during maneuvering to make landings, steam is no longer lost by blow-off to reduce boiler pressure which was frequently the case when a coal burner. This, it is claimed, is accomplished by the wide range in capacity, while still maintaining the same atomizing power, of the burner, by by-passing a part of the oil back into the line just before it passes through the orifice into the furnace. Immediate slackening of the fires in the furnaces without appreciable loss in burning efficiency is thus made possible by the manipulation of a single valve. In addition to lower fuel costs, labor costs have been reduced by dispensing with the service of 10 men in the engine room crew.

The owners are also impressed with the additional comfort to passengers in the elimination of cinders and the very important matter of freedom from unreasonable demands on the part of firemen and coal passers. As a result of the successful experience with the DEWITT CLINTON, contracts have been placed to convert the HENDRICK HUDSON and the WASHINGTON IRVING to oil burners using the same system and the work is now under way at the W. & A. Fletcher Co., Hoboken, N. J. This system is also being installed in the ALEXANDER HAMILTON.

Details of New Vessel

To keep somewhat ahead of immediate demands and to guarantee adequate service under any circumstances, a new vessel was considered necessary. Consequently, late in 1922 bids were received based on plans and specifications prepared by J. W. Millard & Brother. The contract was awarded to the Sparrows Point, Md., plant of the Bethlehem Shipbuilding Corp. at a figure said to be approximately $800,000. The accompanying illustrations show the ALEXANDER HAMILTON at the time



INBOARD ELEVATION OF NEW SIDE WHEEL STEAMER ALEXANDER HAMILTON

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AMERICAN PASSENGER LINER PRESIDENT HARRISON PULLING OUT OF HER DOCK AT SAN FRANCISCO, THUS BEGINNING THE FIRST ROUND-THE-WORLD PASSENGER AND LINER SERVICE EVER UNDERTAKEN UNDER ANY FLAG. SHE IS OWNED BY THE DOLLAR LINE AND IS ONE OF SEVEN SISTER SHIPS BOUGHT FROM THE SHIPPING BOARD

of her launching on Oct. 20, 1923. Delivery is expected in April, 1924.

Her principal characteristics are:

Hull

Length over all, 348 feet.
Beam, molded, 42 feet.
Beam, over all, 76 feet.
Depth, molded, to main deck, 13 feet.
Height, main deck to salon deck, 9 feet 6 inches.
Height, salon deck to promenade deck, 8 feet.
Steel hull, transverse system.
Fuel tanks built in each side in boiler room.
Side paddle wheels (feathering) 22 feet 6 inches in diameter. Nine paddles, 12 feet 6 inches by 3 feet 9 inches.
Speed estimated at 18 knots.

Machinery

Engine—diagonally inclined, triple expansion, surface condensing.
Diameter of cylinders, 36½ x 57 x 90 inches and 6-foot stroke.
40 revolutions per minute.
Boilers—Scotch type.
Two double-ended, 22 feet long, 12 feet 1 inch diameter.
Two single-ended, 11 feet 4 inches long, 12 feet 1 inch diameter.
180 pounds steam pressure.
Total heating surface, 12,600 square feet.
Howden draft.
12 oil burners, Peabody-Fisher, wide range, special type of hinged fronts.
Auxiliaries.
Main condenser, 5800 square feet.
One centrifugal circulating pump connected to reciprocating steam engine.
One independent air pump.
One independent feed pump.
One sanitary pump.
One bilge pump.
Two fire and auxiliary feed pumps.
One trimming pump.
Two dynamos.
Three fresh water pumps.
Steam steering gear engine.
Feed water heater.
Two oil heaters and pumps.

The trimming pump listed above performs the interesting function of keeping the steamer on an even keel. Two tanks of from 25 to 30 tons capacity each, are located one on each side of the vessel, adjacent to the paddle casings. As the passengers move to or from the sunny side according to the coolness or heat of the day, the ballast tanks referred to on either side can be filled by means of the trimming pump, thus maintaining the vessel on an even keel.

An inboard profile is shown in an accompanying illustration. In passenger accommodations, in number of decks and in general dimensions, the new ALEXANDER HAMILTON is approximately the same as the ROBERT FULTON. The dining room is located on the main deck and the private parlors on the salon deck. All passenger spaces are enclosed by wide plate glass windows which may be lowered or raised as desired. In every respect, this vessel will be one of the finest river steamers ever constructed and she will be a notable addition to the Hudson river passenger fleet.

Prospects for financing a new steamship line between west Ireland and New York or Halifax are again reported as excellent. For years, a plan has existed for developing a port at Blacksod bay, Ireland, which owing to its westerly position would cut down the time of the transatlantic passage. The British government at one time approved railroad construction to reach the bay. American and English capital are reported as interested in the revival of the plan.

Five English groups control 40 per cent of the British empire's total seagoing tonnage or about 14 per cent of the world's total, according to a London report. Viscount Inchcape heads the British India, Peninsular & Oriental, Federal Steam Navigation, New Zealand Shipping, Hain Co., and Union Co. of New Zealand group with a total of 2,380,293 tons. Lord Kylsant controls the Royal Mail Steam Packet, Elder Dempster, Union Castle, Lamport & Holt, Pacific Steam Navigation and H. W. Nelson group with 2,276,000 tons. In the White Star group are the Leyland line, Shaw Savill & Albion, Atlantic Transport, International Navigation and Aberdeen line with 1,310,368 tons. Cunard organization includes the Commonwealth, Dominion, Brocklebank, Anchor and Donaldson lines with 1,155,505 tons. Sir J. R. Ellerman is the head of the fifth group with 1,126,793 tons.

Start Work on Big Lake Iron Ore Carrier

Work has been started by the Great Lakes Engineering Works, Detroit, on a new bulk freighter for the Franklin Steamship Co., Cleveland, of which Herbert K. Oakes is manager. This vessel duplicates in size the two Ford ships now being built, being 612 feet in length over all, 586 feet keel, 62 feet beam and 32 feet deep. She will be driven by a triple expansion engine and fitted with three Scotch boilers. The cost will run about $1,000,000 and delivery will be made in September.

Sixteen diesel engined vessels will run in the frozen meat trade between King sound, Kimberley, Western Australia, to London. The plan has been considered for several years, but the approval of the Australian government and the securing of capital now permits a start. Two ships are being built at the Beardmore yards and the others will also be British built. One of the causes of delay was to await the time when ship construction costs in the British Isles would retreat to the European level as the promoters wanted to favor the British plants.

The CLEVELAND of the United American line will call at Halifax, N. S., on her westbound March trip, inaugurating the Canadian call of the joint service with the Hamburg American line. The MOUNT CLAY of the United American and the HANSA of the Hamburg American, all three one class cabin ships, will maintain the service.

Increased mail tonnage on the American liners operating between Seattle and the Orient has made it necessary to add three mail seapost clerks to each of the five vessels on the route.

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Install Large Still Type Engine

English Shipowner Is Using Two 1250-Horsepower Units of This New Design To Drive 400-Foot Freighter

ENGINES of the Scott-Still type are being installed on the twin-screw motorship DOLIUS building for Alfred Holt & Co., Liverpool, England. Experiments have been carried through successfully for some months at the Greenock works of the Scott's Shipbuilding & Engineering Co. on these engines. The descriptive information which follows was obtained by MARINE REVIEW's manager at London directly from the engine builders. The ship itself is 400 feet in length, 52 feet beam, 32 feet in depth and displaces 11,650 tons.

The engines operate on the 2-stroke cycle, have four cylinders and develop 1250 shaft horsepower each at 120 revolutions per minute. They have a 22-inch bore and a 36-inch stroke.

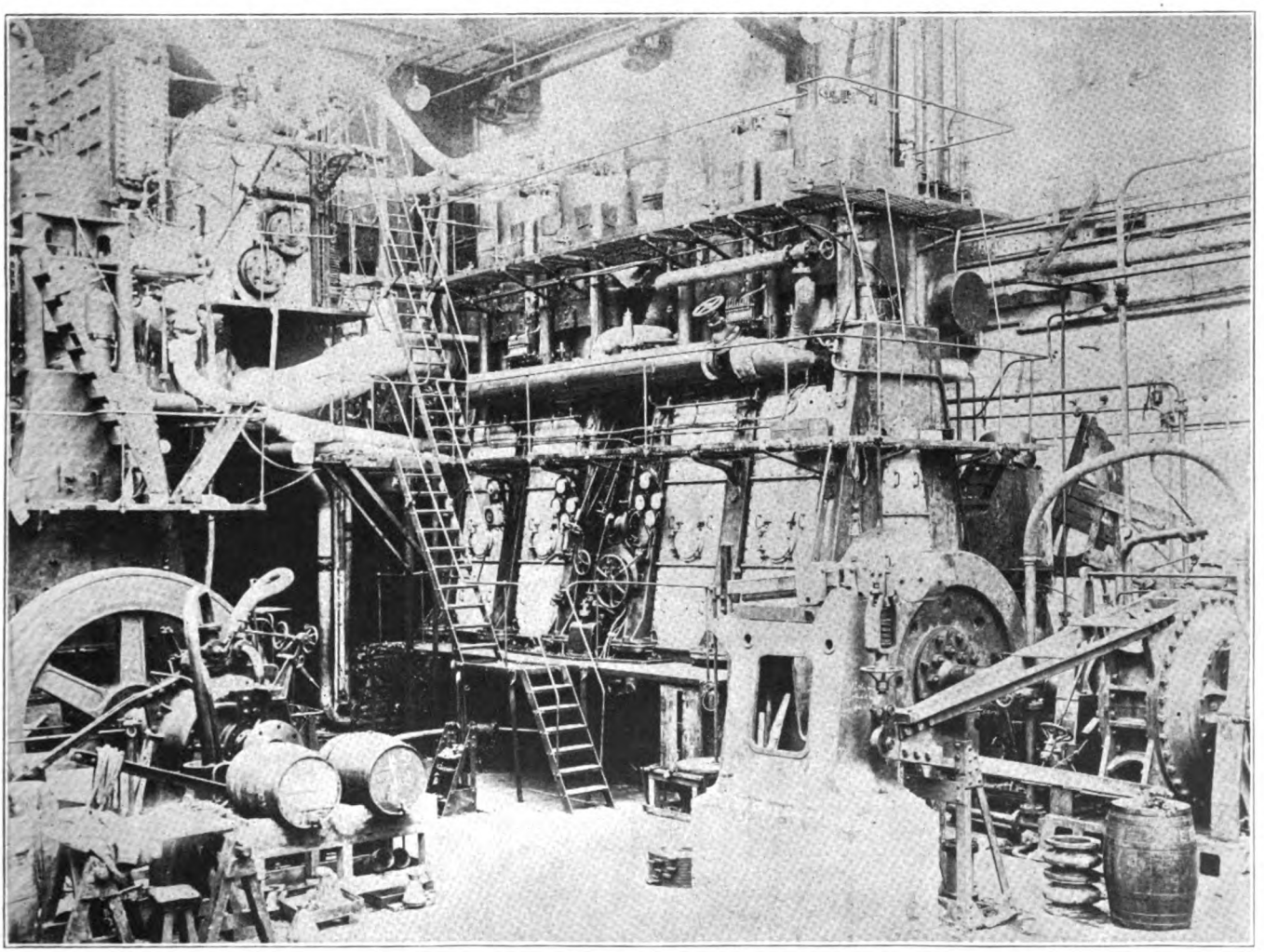
The cylinders are cast iron, in one piece with the combustion head, which contains a single hole for the injection valve. The cylinders are only ⅝ inch thick, and have longitudinal ribs reinforced by forged steel hoops which take the bursting stresses, while the thinness insures that the heat stresses are a minimum.

The jackets are steel castings to withstand the boiler pressure inside. The top of the liners carrying the jets, pass through stuffing boxes in the jackets, allowing free expansion. The crankshaft is the semi-built-up type, in two 2-throw halves, with flanged coupling in the centers. The two halves are interchangeable and the extra flange at the forward end is used to carry a fly-crank which drives a rocking beam, from which are driven auxiliary pumps for the steam side.

The auxiliaries, driven by the engine from the forward end flange of the crankshaft by a rocking beam, include: Condenser air pump, 14-inch bore x 15-inch stroke; boiler feed pump, 2-inch bore x 7-inch stroke; forced lubrication double acting pump, 4.75-inch bore x 7-inch stroke; bilge pump, 6.3-inch bore x 7-inch stroke; oil separator drain pump, 3½-inch bore x 3¼-inch stroke; boiler filter pump, 7-inch bore x 7-inch stroke.

Separately driven are: one Hele Shaw variable delivery pump actuated by an electric motor for supplying lubricating oil at 400 pounds pressure for operating the steam valve hydraulic system of both engines, power required for one engine about 7 horsepower; condenser circulating water pump which is an electrically driven centrifugal pump for both engines; burner fuel pump. For emergency use are a duplicate valve gear oil pump and motor, a steam driven Weir feed pump, a steam driven forced lubrication pump and an evaporator.

The combustion side operates on the 2-stroke cycle with port scavenge. Fuel is injected on the "solid injection" principle. Since no compressed air is re-



SCOTT-STILL TYPE ENGINE INSTALLED IN BRITISH MOTORSHIP DOLIUS OF THE HOLT LINE

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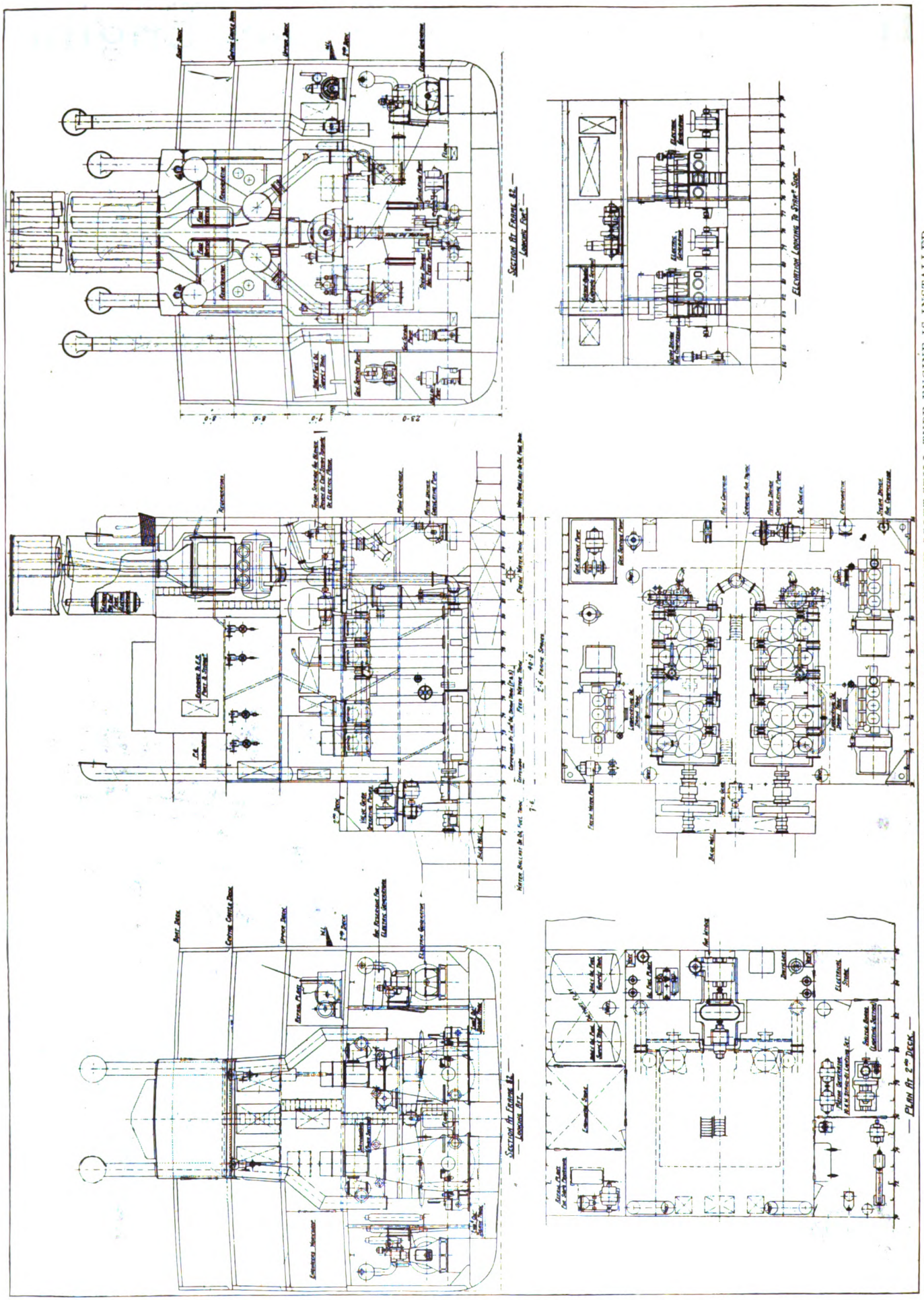

ARRANGEMENT OF MACHINERY ON MOTORSHIP DOLIUS IN WHICH SCOTT-STILL TYPE ENGINE IS INSTALLED

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quired for this purpose, and starting is effected by steam, no high pressure air compressors, storage bottles or auxiliary engines are required in the installation. The combustion cycle is what is termed a "duel cycle," in that it is in part a constant volume combustion and in part a constant pressure combustion, the oil being admitted rather before dead center. This is adopted owing to the much lower compression pressure possible than in a diesel engine. Owing to the hot jackets and walls of the Still engine, a compression pressure of only 300 to 320 pounds per square inch is ample to insure ignition even when starting from rest, while the maximum pressure is of the same order as usual. This fact is of great importance, since the risk of excessive pressures in the cylinders is entirely eliminated.

The fuel valves or jets are automatic in action and open by the pressure of oil in the fuel pipe, timed by the pumps.

The oil fuel pumps of 1¼-inch bore are located on the bed of the engine and are operated by cams on the crankshaft coupling. The amount of oil delivered to the engine is varied by spill valves which open earlier or later in the pump stroke as desired, not by varying the stroke of the pump or the lift of the suction valves. The opening of the spill valves is controlled by hand, and a governor is fitted to limit maximum speed and prevent racing.

Reversing is accomplished by sliding the pump cam rollers sideways to engage either with the ahead or astern cams, which are side by side on the shaft.

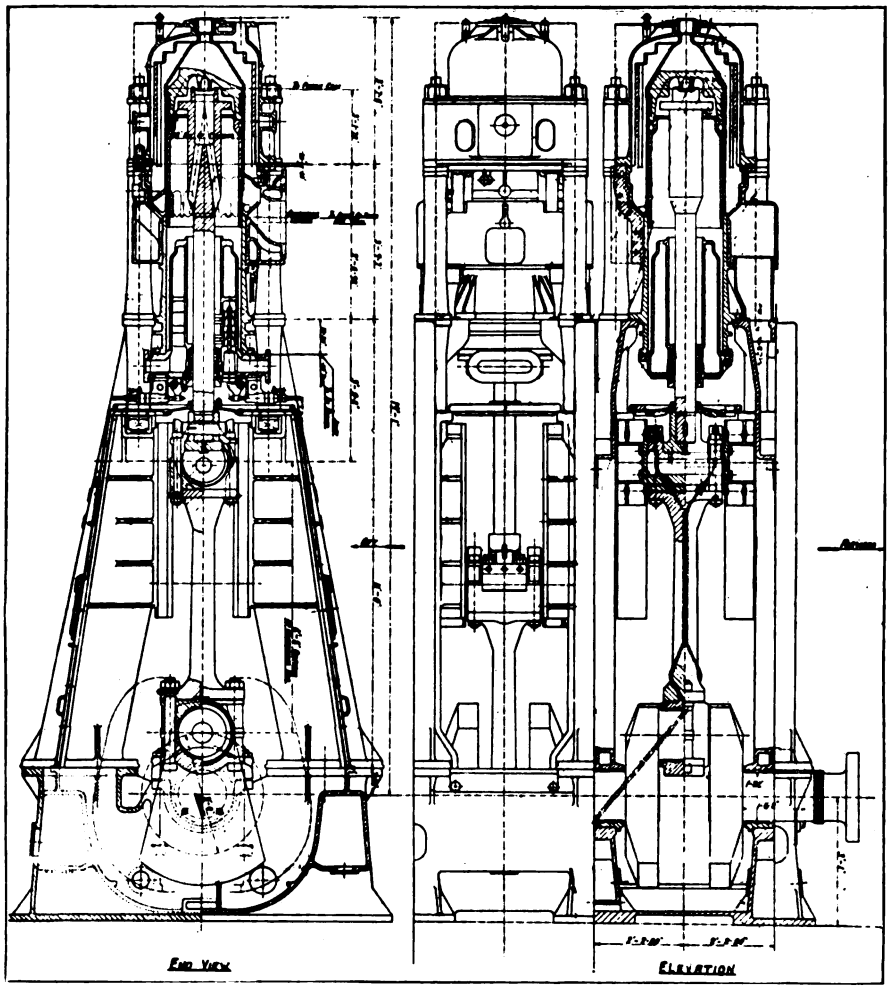
Scavenging System

The scavenge air for both engines is supplied by one turbo-blower set built by Brown-Boveri of Baden, driven by an exhaust steam turbine taking steam after it has passed through the main engines on its way to the condenser. On the same shaft is also coupled a 220-volt motor which serves to drive the blower in case of accident to the turbine, or to assist the turbine either when insufficient exhaust steam is available or when for any cause the vacuum is low. Thus two alternative methods of driving the blower are provided and no stand-by plant is required.

If more steam power is available than is required to supply the necessary scavenge air, the motor will be driven as a dynamo and put power into the ship's mains.

The air from the blower is led down into the bedplate of the engine and passes thence up through the hollow A-frames to the scavenge ports of the cylinders.

On the steam side, when running normally, steam is generated only from the waste heat of the combustion engine. For maneuvering and overload, the evaporation can be supplemented by the use of oil burners under a boiler.



ENGINE ARRANGEMENT ON MOTORSHIP DOLIUS

Steam is generated by the exhaust gases, which are led directly from the exhaust ports through a small water-tube generator, of 86 square feet heating surface, attached to each cylinder and thence by a lagged cast iron pipe to a bank of cross tubes, 497 square feet heating surface, in the lower (water) drum of a Yarrow type boiler, arranged at a higher level than the cylinder tops. One is provided for each engine. From this, the gases pass through a feed-water heater of 1027 square feet heating surface to the stack.

The heat which passes through the walls and head of the combustion cylinder is also used to generate steam. Water is led by natural circulation down from the water drum of the boiler to a junction piece, whence the pipe divides and leads up through the four small generators into the bottom of each cylinder jacket. After passing through the jackets, the water now highly charged with steam, is collected into a common pipe and led back to the top drum of the boiler, where the steam separates out.

Two burners are fitted in the furnace front of the boiler and utilize the water tubes, with 882 square feet heating surface, for raising steam initially or for generating additional steam for maneuvering or for overload. In the event of complete breakdown of the combustion engines, these boilers are capable of propelling the ship at reduced speed.

The feed water from the hot-well is pumped through special duplicate oil filters. As much lubricating oil as possible is extracted from the steam in an exhaust steam separator, fitted between the engine and the scavenge air turbine.

The steam so generated is used expansively on the under side of the combustion pistons. Under ordinary running conditions, the after cylinder acts as a high pressure cylinder, and the remaining three as intermediate pressure cylinders, the steam finally being expanded right down to about 28-inch vacuum in a low pressure turbine which drives the scavenge turbo-blower. The mean pressure indicated on the steam side of the engine cylinders is that of two expansions only, the third expansion not appearing as indicated power.

The condenser is of the usual marine surface type, and one serves both en-

(Concluded on Page 91)

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What the British Are Doing

Short Surveys of Important Activities in Maritime Centers of Island Empire

REPORTS to Lloyd's Register of Shipping for the last quarter of 1923 show that at the end of the year, 759 vessels of more than 100 tons aggregating 2,444,336 gross tons were under construction throughout the world. Of these, 360 ships of 1,395,181 gross tons were being built in Great Britain and Ireland and 399 of 1,049,155 tons in other countries. In the United States, 35 ships of 91,585 gross tons were under construction on Dec. 31, 1923. Most of this construction is on the Great Lakes where seven steamers of 32,900 tons and two motorships of 16,400 tons are being built compared with nine steamers of 20,585 tons and 12 motorships of 17,400 tons on the Atlantic coast. Only one ship of 1300 tons was under construction on the Pacific coast at the end of the year.

Next to Great Britain, Germany had the most new tonnage under way when the new year opened, the figure being 92 vessels of 324,184 tons. Italy now stands third with 38 ships of 119,663 tons building, and France fourth with 24 ships of 110,725 tons. The United States is in the fifth place and Japan sixth, building 20 ships of 63,207 tons.

In the last quarter of last year, 127 vessels of 331,993 tons were launched, including 35 registering 114,583 tons in Great Britain, 22 ships of 68,041 tons in Germany, and 16 vessels of 27,550 tons in the United States. In the same quarter, 205 ships of 472,578 tons were commenced of which 93 registering 244,506 tons were in Great Britain, 37 of 90,346 in Germany, 17 of 37,300 tons in the United States, and 8 of 25,247 tons in Denmark. The tonnage commenced in the last quarter of last year shows a considerable increase over the third quarter, during which work was begun on only 111,860 tons.

Total tonnage under construction on Dec. 31 included 231,000 tons on which work is suspended. At present, 31 vessels of between 10,000 and 20,000 tons each and seven of 20,000 tons and larger are under construction. All of the latter are British together with 19 of the 31 ships in the 10,000 to 20,000-ton class.

* * *

WILFRED AYRE of the Burntisland Shipbuilding Co. has provided statistics showing that steel materials for shipbuilding are now 39 per cent above the prewar and 13½ per cent above what they were at the beginning of 1923. Timber is dearer by 3 to 4 per cent but reductions of 4 per cent on coal and power, 24 per cent in deck machinery, 3 per cent in anchors and cables, and 2 per cent in engines and boilers have been made. Taking other elements into account, the cost of tonnage production today is higher by about 2 per cent or about 5 shillings per ton deadweight than it was 12 months ago. Mr. Ayre adds that whenever steel prices advance orders for new ship tonnage decrease and an increase or reduction of 10 shillings per ton in steel prices represents just that difference which influences British shipowners in placing or withholding contracts for new tonnages.

* * *

JOHN BROWN & CO., LTD., Clydebank, have obtained an order for two passenger steamers for the Canadian Pacific Steamships Ltd. The vessels, which will be of a specially high class, are intended for coasting services between Vancouver, B. C., and Seattle and—in the summer—north of Vancouver. Order for a floating dock for Lagos, West Africa, and for several colliers have been secured by Swan Hunter & Wigham Richardson, Wallsend-on-Tyne.

* * *

WORK has been commenced on a new dock to be built at Glasgow at a cost of £2,000,000. When completed it will be the largest in Great Britain and will accommodate the largest vessels sailing into Glasgow. The area of the water will be 40 acres and the width of the basin 350 feet. Some years ago, the Clyde Navigation trustees acquired land on the south side of the Clyde between Sheildhall and Renfrew having a frontage of about 1¾ miles. It is intended when the first dock is complete to construct others. The scheme includes the construction of a road with three concrete bridges over the railway.

* * *

SHIPPING outlook for 1924 is gaged by J. W. Kempster managing director of Harland & Wolff at Greenock on the Clyde, as follows: "I am glad to say that there is every prospect of Harland & Wolff's Greenock works being well employed during the coming 12 months, given good will and mutual understanding between the various sections of our industrial community, whether brain or brawn workers, so essential to the continuity of work. At the same time, taking a wide view, it is obvious that if shipbuilding is to recover there must be a more general revival of the world's trade.

"At the present time, according to the best authorities, the cargoes interchanged between the countries of the whole world are still not more in bulk than 80 per cent of those carried before the war, while the tonnage available is now much greater. Until the various peoples and more particularly the inhabitants of erstwhile industrial Europe settle down to peaceful production and freely interchange their goods and services once again, there can neither be stability nor a general renaissance of shipbuilding and its dependent trades."

* * *

GRANT BARCLAY, president of the Shipbuilding Employers federation in a forecast of shipbuilding prospects says that for the last generation, warship construction has formed a considerable proportion of the annual shipbuilding output but neither employers nor workmen can rely on the same proportions in the future. The building capacity of the industry was increased by about one-third to meet wartime requirements and the personnel of the industry was likewise augmented. This additional capacity added to that engaged in prewar times on warship work and for which warship construction would not be available meant that the country had not far short of double the facilities and the men to be maintained upon merchant shipbuilding as compared with prewar.

* * *

LORD INCHCAPE, chairman of the Peninsular & Oriental Steam Navigation Co., and numerous other British shipping and banking organizations trading with the Far East, has been created viscount in recognition of his eminent services in developing British empire communications.

E. V. MURPHY has been appointed advertising and publicity manager for the Pacific Mail Steamship Co. with offices at 508 California street, San Francisco, in place of J. D. BAKER who recently resigned.

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Orders Second Pair of Electric Ferryboats

The Golden Gate Ferry Co., San Francisco, has placed a repeat order with the General Electric Co., Schenectady, N. Y., for complete electric propulsion and control machinery for two new steel hull, double-ended ferry boats. These crafts will probably be operated in the same manner as the GOLDEN GATE and GOLDEN WEST, equipped with General Electric propulsion and control machinery and now running between Sausalito and San Francisco. The new boats will be run between the same points releasing the older craft for new routes.

The two new ferryboats will be somewhat larger than the previous craft, having instead of two main generating sets, three Werkspoor diesel engines each direct-connected to a 270-kilowatt, 250-volt, direct current generator. A 30-kilowatt auxiliary generator will be mounted on an extension of each main generator shaft.

Two 950/150 shaft horsepower, 180/150 revolutions per minute, 750 volt, intermittently rated motors will be mounted in each end of the boats and direct-connected to the propeller shafts. These motors will have a constant rating of 900 shaft horsepower at 180 revolutions per minute. Ward Leonard type of voltage control will be employed and both pilot house and engine room control will be available.

The Golden Gate Ferry Co., with its first two electrically equipped boats, inaugurated a radical departure in ferryboat construction, these being the first double-ended craft where each propeller was driven separately.

Lacking official status, the British steamship, ARDENZA is lying in quarantine at Victoria, B. C., a ship without a country. This unusual situation is due to the fact that the vessel arrived without papers and until these can be duplicated from Glasgow, from which port the ARDENZA cleared she will be kept under surveillance. Eight months ago, the ARDENZA left Glasgow. During the long voyage, trouble developed and finally during a fight between the master and one of the stewards the latter cast the ship's papers overboard. This left the steamer in an unfortunate predicament and the British Columbia officials have decided she can not enter until duplicate papers are furnished. The ARDENZA has cargo for Victoria, including 8000 cases of whiskey.

While undergoing overhauling at a Seattle pier, with 500 workmen aboard, the coasting steamship EMMA ALEXANDER, formerly the CONGRESS, was the victim of a peculiar accident. Without warning, the vessel took a sudden list. Through an open port, sea water rushed in, the door of the port becoming jammed so it could not be closed. By means of bulkheads, water was kept out of part of the steamer, but the after end filled and the EMMA ALEXANDER sank in shallow water. Fireboats and tugs relieved her in a few hours but it was necessary to send her back to drydock to undergo examination for hull damage. The EMMA ALEXANDER resumed her former run between Seattle and San Pedro in February.

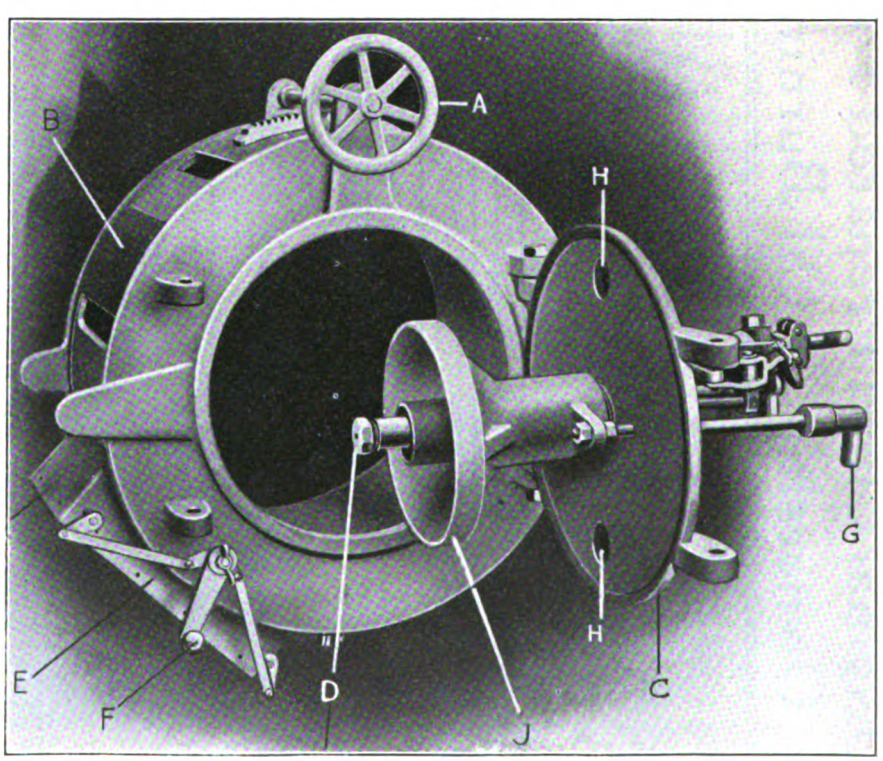
Develop Practical Oil Burning System

RAPID development in the burning of oil as fuel in American factories, power houses and industrial plants and on board American ships, has been due principally to three reasons. First, the continued discovery of large deposits of oil within the country and in nearby territories and the consequent tremendous expansion of oil production. Second, the many recognized advantages of oil over coal as a fuel, particularly for ships among which may be enumerated increased boiler efficiency, less weight, and space occupied by bunkers, increased steaming radius, less labor, a more contented crew, and quickness and ease of bunkering. Third, the practical genius of American engineers, in quickly perfecting the mechanical appliances for efficient and safe systems of burning oil.

Of the reasons enumerated above, the second applies universally. The third depends partly on the first in that a plentiful supply created a natural incentive for the development of correct appliances for burning oil. The possession of, or the ready access to, fuel oil by different nations, therefore, has had its marked effect in the adoption of oil as fuel.

The analysis in the accompanying table of the distribution of oil burning ships among the nations of the world shows that the United States held a very marked lead in 1914 and that this lead has been increased since then. In 1914, of a total of 441 vessels of 500 gross tons and over, burning oil, the United States had 231, or more than one-half. In 1923 out of a total of 2917 vessels in this class, 1757 or 60 per cent were American.

Though the present keen national rivalry for an appropriate share in the oil deposits in regions where it is



NATURAL AND FORCED DRAFT TYPE AIR REGISTER WITH DOOR SWUNG OPEN

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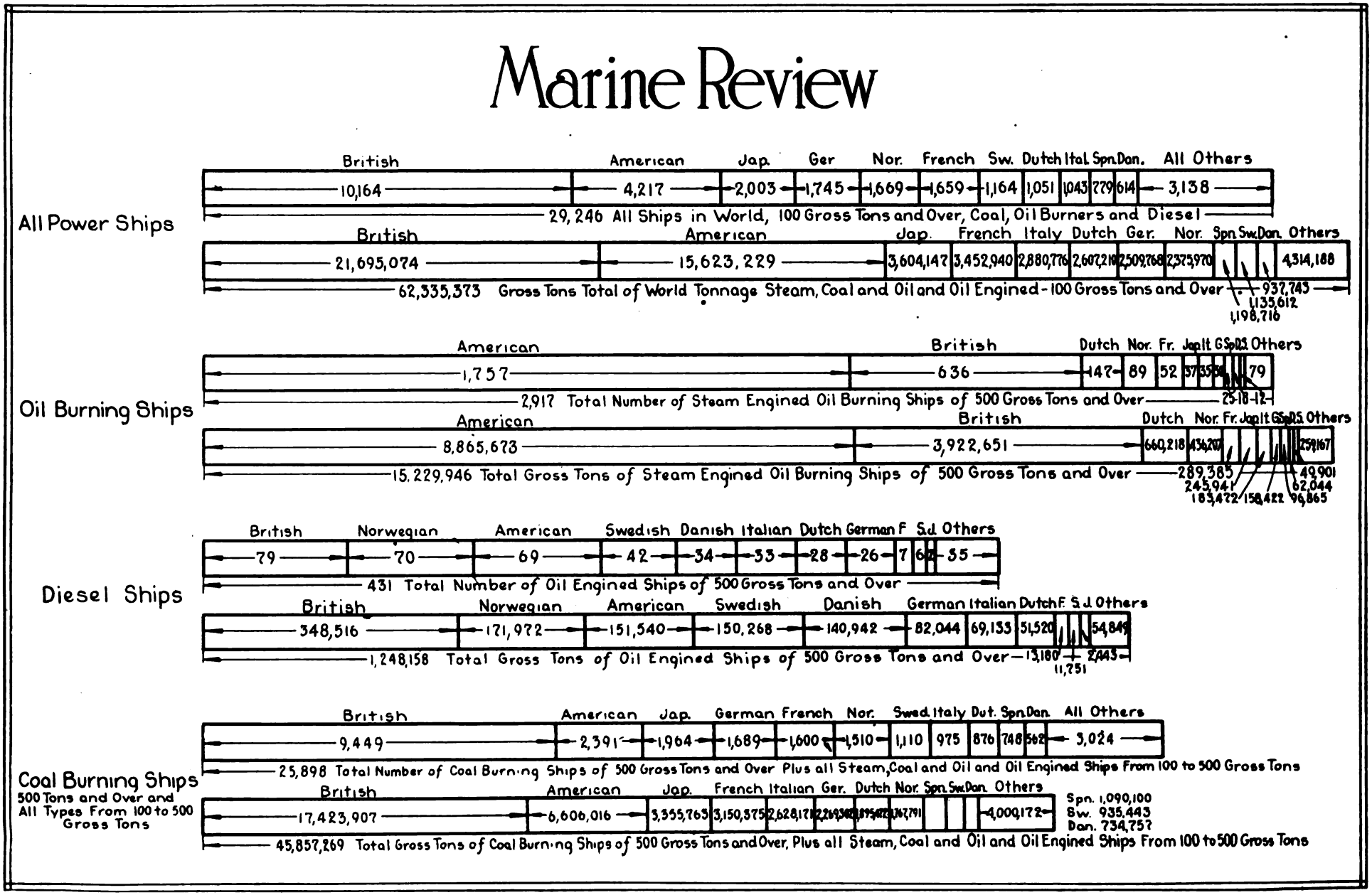
Original Chart Prepared To Show How Nations of the World Divide Ownership of Oil Burning, Diesel and Coal Burning Vessels



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known to exist, outside of the immediate territories of powerful and well organized governments, clearly indicates the great weight of economic reasons for the disparity in the development of its use, the progressiveness, energy and technical skill of a great number of American engineering companies, shipyards and ship repair concerns in developing and perfecting appliances for burning oil has also had a powerful effect in popularizing the use of oil as fuel and making the United States the leader.

Many oil burning systems developed in the United States are well known due to the publicity they have received and the numerous important installations made both ashore and afloat. Other good systems incorporating features of considerable merit though not so generally known have also been developed and have had their part in the rapid increase in use of fuel oil. Among these latter is the complete oil burning system for natural or forced draft developed during the past 10 years by the Briggs Engineering Co., Inc., of 219 Twenty-fourth street, Brooklyn. A number of installations have been made in freighters, yachts, tugs and in industrial plants. The accompanying illustrations show the standard air register with door swung open and also one of the assembled duplex pumping, heating and straining units of this system. An inspection of this system discloses no departure from the recognized principles of mechanical oil burning. But simplicity, compactness, orderliness of arrangement and high quality of material and workmanship in these units was particularly provided for in the design. With natural draft, admission of air for combustion is regulated by a hand wheel which operates shutters over eight openings around the furnace front. A close adjustment of the air supply is, therefore, possible from full open to shut. When forced draft is used the amount of air is regulated by a double damper fitted with an operating lever which can be locked in any position. The oil is atomized in the customary manner by being passed through a burner tip under pressure. A movable cast iron cone can be regulated in relation to the burner tip. The furnace front is entirely plain and no stationary vanes are fitted. The burner and adjustments are attached to a swinging door arranged to swing out in either direction without removing the burner and its gear. In this manner access can be had to the furnace with a minimum of inconvenience. As an important measure of safety the burner goose neck cannot be disconnected from the burner proper before shutting off the oil supply, and when so disconnected the supply of fuel oil is automatically shut off.

World Distribution of Steam Engined Oil Burning Vessels

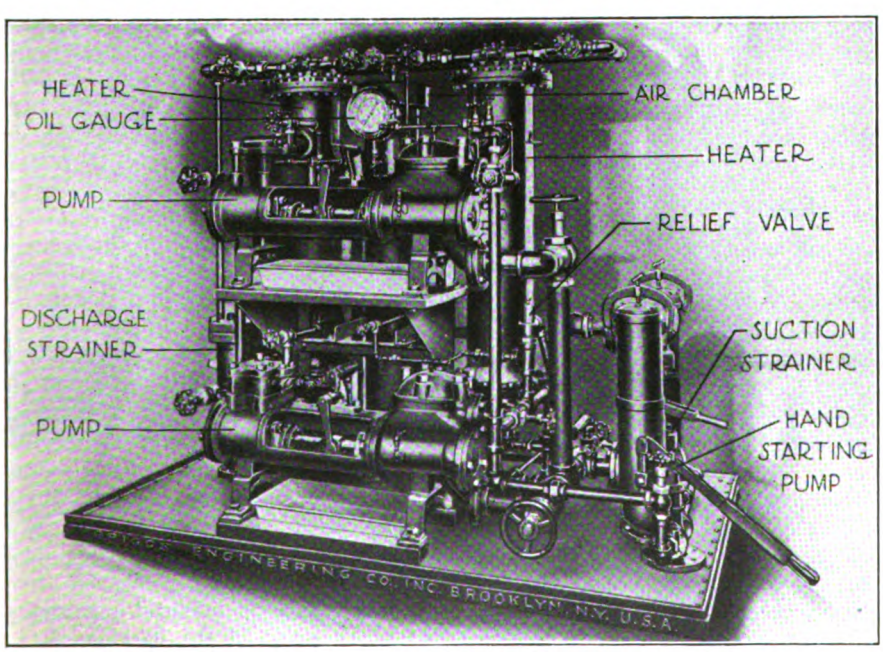
500 gross tons and over

June 30, 1014

	Nos.	Per cent	Gross tonnage	Per cent
American	231	52.3	646,048	42.3
British	111	25.2	526,585	34.5
Dutch	36	8.2	76,535	5.0
German	23	5.2	119,138	7.8
All others	40	9.1	159,422	10.4
	441	100.0	1,527,728	100.0

June 30, 1923

	Nos.	Per cent	Gross tonnage	Per cent
American	1757	60.0	8,865,673	58.2
British	636	21.9	3,922,651	25.8
Dutch	147	5.1	660,218	4.4
Norwegian	89	3.1	436,207	2.9
French	52	1.8	289,385	1.9
Japanese	37	1.3	245,941	1.6
Italian	35	1.2	183,472	1.2
German	30	1.0	158,422	1.0
Spanish	25	0.9	96,865	0.6
Danish	18	0.6	62,044	0.4
Swedish	12	0.4	49,901	0.3
All others	79	2.7	259,167	1.7
Total	2917	100.0	15,229,946	100.0



ASSEMBLED OIL BURNING UNIT INCLUDING TWO HEATERS, TWO PUMPS, A DUPLEX SUCTION AND A DUPLEX PRESSURE STRAINER

The oil heaters are of the straight tube type substantially constructed and so arranged that the oil passes through the length of the heater eight times before passing into the line to the boiler. It is possible to heat the oil to a temperature of 300 degrees Fahr. in these heaters. The elements of the heater are of ½-inch steel tubes and they can be readily renewed when necessary. All joints are outside joints, eliminating the possibility of the steam mixing with oil. The tubes can be easily cleaned with a rod.

Before the oil passes into the furnace, it is strained at three different points in the system. One of the duplex strainers is used in the low pressure or the suction line leading to the pumps, the other in the high pressure or discharge line leading to the burners. The third strainer is located in the burner body and is readily accessible for cleaning. A ratio of 35 to 1 of straining area to pipe area is obtained in the suction strainer and a ratio of 20 to 1 in the discharge strainer. This large ratio reduces the frequency of cleaning required. The strainers are constructed of substantial steel screening protected by a

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covering of perforated steel. A test of 500 pounds and 100 pounds per square inch is applied respectively to the pressure strainer and the suction strainer to insure tightness. Change of flow of oil from one side of the strainer to the other or through both strainers at once is accomplished by moving a control lever in a vertical plane. These strainers are also made simplex and arranged with a by-pass.

The heaters, strainers and pumps, all mounted in duplex on a separate steel plate platform as shown in the accompanying illustration, located conveniently in the fire room, makes a compact and easily accessible unit. This assembled unit consists of two pumps, two heaters, a duplex suction and a duplex pressure strainer and necessary gages, fittings, supports and base. On the delivery of such a unit to the fire room it is only necessary to connect the suction strainer to the oil supply line and the pressure strainer to the discharge line leading to the burners, and to make the necessary steam connections.

The entire oil burning system described above has been developed to meet the requirements for both marine and stationary installations in a direct and simple manner.

When the Admiral express liner H. F. ALEXANDER returns to the Pacific coasting run in March, after undergoing repairs occupying several months, she will again be commanded by Capt. E. P. Bartlett and Capt. George H. Zeh. This vessel operates on such a fast schedule that experience has proved it too exacting for one master. Consequently Captain Bartlett and Captain Zeh have a week's vacation ashore between voyages.

Coal exports from the United States in 1923 are tentatively figured at 23,700,000 long tons. The 1914 exports were 19,665,000 long tons while in 1920, coal exports were up to 39,215,000 long tons. Last year showed a splendid gain over 1922, when only 13,450,000 long tons left this country. Canada, of course, is the big customer. In overseas exports, France with 840,000 long tons, Cuba with 610,000; Italy with 585,000; Netherlands with 379,000; Germany with 335,000; Brazil with 310,000; West Indies with 287,000; Argentina with 130,000 and Mexico and Central America with 123,000 long tons, are the leaders.

Canada Has World's Largest Drydock

BY E. L. CHICANOT

CANADA has made another addition to her notable list of big things, done. A project dreamed of many years ago and in 1912 actually initiated has just arrived at completion after meeting many delays This is the new drydock at St. John New Brunswick, which gives to Canada the largest and one of the most completely equipped drydocks in the world.

St. John is Canada's principal inlet and outlet on the Atlantic coast. When the ice forms on the St. Lawrence, terminating the busy months at Montreal, Quebec, and other gulf ports St. John is called upon to carry on the greater part of Canada's versatile business which in the summer passes up the river. Though St. John is largely neglected from May to December for Montreal and Quebec, and its real season of activity commences after freeze-up, it has a profitable amount of business the year round. Its exports amount to about $100,000,000 per year and its imports to $50,000,000.

The dominion government in 1911 succeeded in interesting English capitalists in undertaking the construction of a first class drydock and repair yard at St. John. Actual construction operations were commenced in 1912 and in 1914, at the outbreak of the world war, extensive operations were under way on the excavation and preparation of the dock site. The project felt the pinch of war time and after struggling along for two years, further construction work ceased, and the company was relieved of further obligations. In the fall of 1918, the St. John Dry Dock & Shipbuilding Co., representing Canadian capital entirely, took up the task, assumed the obligations of the original company, and carried the work on to its present successful completion.

The overall length of the dock is 1150 feet width at entrance 120 feet with 40 feet of water over the entrance sill at the extreme high tide. A comparison of these dimensions with those of other modern drydocks discloses the fact that the St. John dock is actually the largest in the world. The largest vessels afloat today, the liners LEVIATHAN and MAJESTIC are only about 950 feet long. This dock is being provided with intermediate sill which will give two separate chambers, the inner 500 feet and the outer 650 feet in length.

Repair Plant Is Complete

An all-important adjunct to the modern drydock is a complete and readily accessible repair plant, and this is provided. It consists of a power house, machine shop, boiler, blacksmith and fabricating shop, as well as a carpenter shop and stores building with second story accommodation for a mold loft. These buildings are all of reinforced concrete construction and are located immediately alongside the dock and parallel to its length, yet with ample working area between buildings and the side of the dock.

An underground tunnel connects all buildings with the power house, so that electrical energy, steam for heating and power, compressed air and water will be supplied to each with no wires or pipes above ground to interfere with or be damaged by the movement of materials between the buildings and the dock. These buildings are well equipped with all necessary machines.

In order to accommodate any small vessels which, if received at the dry dock for repairs would be subject to docking and lay day charges quite out of proportion to their size, a marine railway is provided alongside the dock entrance which will accommodate any vessel up to two hundred and fifty feet in length with a dead weight not in excess of eighteen hundred tons. This slipway consists of a carriage or cradle fitted with keel and bilge blocks traveling on a wide gage inclined track, extending down to below low tide.

The vessel to be docked is floated at high tide to a position in contact with the cradle lowered to the bottom of the incline. The keel and bilge blocks are then adjusted to fit the vessel's bottom and the carriage and vessel are slowly hauled up the grade by a large winding engine located at the head of the slipway. The cradle thus receives the full vessel weight and then is drawn to the top of the incline, when the vessel is then in a position entirely above high tide level and accessible at all points for continuous repair or overhaul operations. At every point in the docking chamber of the drydock electricity for light and power, compressed air, water

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and live steam are provided, to facilitate rapid work on vessels. An intercommunicating telephone system throughout the dock is separate from the system between the offices and shops. Complete pumping station and equipment is of course provided. A complete sewerage system for the dry-dock enables a vessel to enter and have all necessary work done without any interruption of its usual wastage discharge.

The dry dock is equipped with a locomotive type crane with a lifting capacity of twenty tons at eightly foot radius, and this machine with the track layout will serve both dock and repair yard. A fixed derrick will lift 75 tons at a 65-foot radius on the wharf at the entrance to the dry dock, so that heavy lifts may be made when required.

Install Large Still-Type Engine

(*Concluded from Page* 85)

gines, with a tube surface of 1000 square feet.

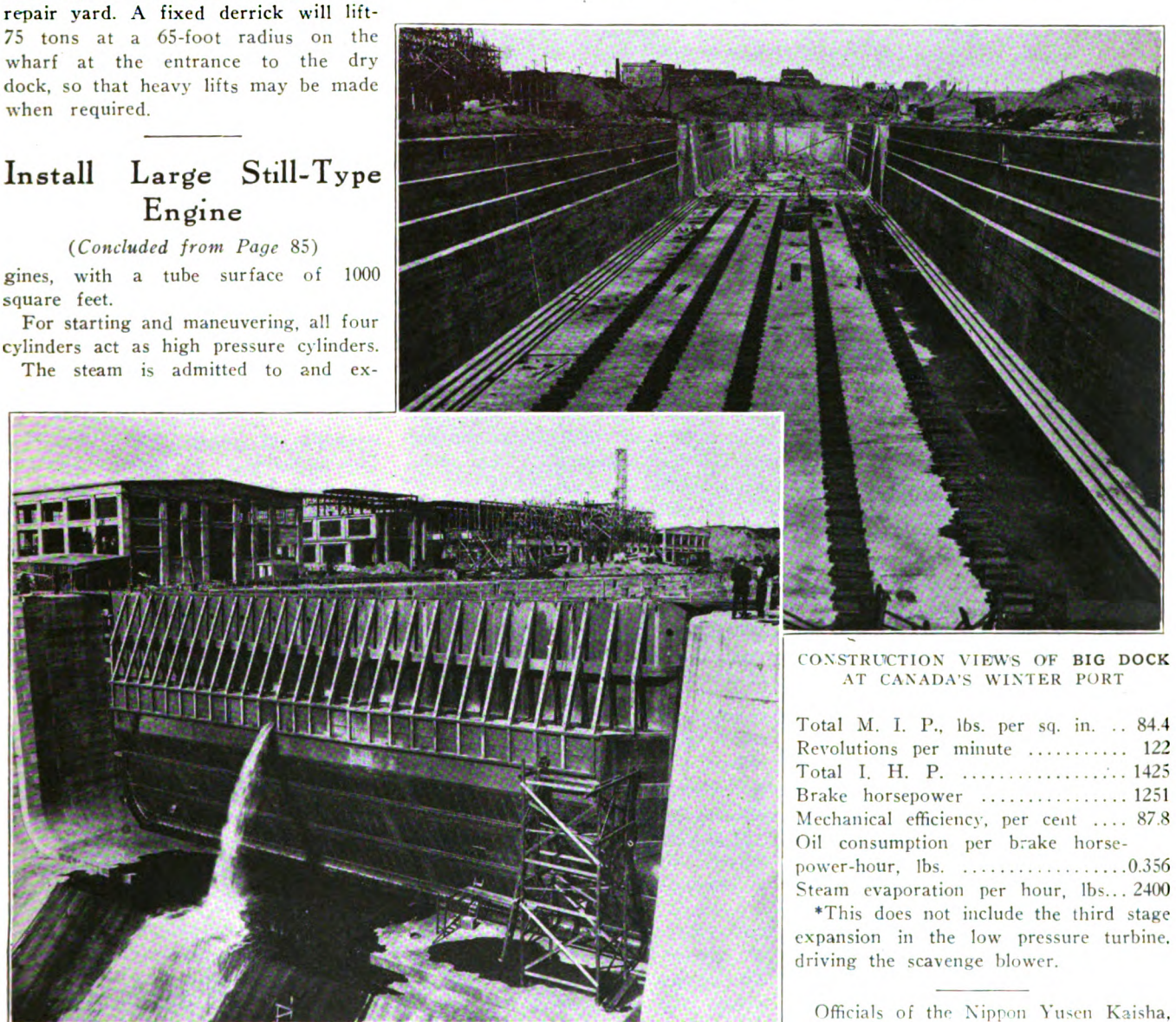
For starting and maneuvering, all four cylinders act as high pressure cylinders. The steam is admitted to and exhausted from the engine cylinders by piston valves of 3½-inch diameter located in the steam covers. In each cover are three similar valves, one admission and two exhaust. These are operated by oil pressure at 400 pounds per square inch, controlled by a distributor and supplied by a Hele-Shaw variable delivery pump, driven by a motor. A second pump set is held in reserve, one pump being capable of supplying the oil for both engines. The power absorber on the one engine is just under 7 electric horsepower. Control is centered in one large hand wheel and the steam stop valve. Rotation of the hand wheel in one direction is for ahead and in the opposite direction for astern running. The first few degrees of movement in either direction sets the fuel pump rollers on the correct cams. The second step further admits steam under the pistons with a long cut-off, and the last step shortens the cut-off to the normal running condition and allows fuel to be injected into the combustion cylinders.

A handle on a quadrant adjusts the quantity of fuel admitted on each stroke, and a similar one sets the speed at which the governor cuts out the fuel. These two are interlocked. A separate hand-wheel changes the steam system from compound running to simple expansion, or *vice versa*.

Full results have not been published of the recent official trials of this engine under the auspices of the marine oil engine trials committee, jointly appointed by the Institutions of Mechanical Engineers and of Naval Architects. The following summary figures are typical of full load trials carried out by the builders themselves:

Average combustion, M. I. P., lbs. per sq. in.	77.8
*Average steam, M. I. P., per sq. in.	6.6

(Referred to the combustion swept volume.)



CONSTRUCTION VIEWS OF BIG DOCK AT CANADA'S WINTER PORT

Total M. I. P., lbs. per sq. in.	84.4
Revolutions per minute	122
Total I. H. P.	1425
Brake horsepower	1251
Mechanical efficiency, per cent	87.8
Oil consumption per brake horsepower-hour, lbs.	0.356
Steam evaporation per hour, lbs.	2400

*This does not include the third stage expansion in the low pressure turbine, driving the scavenge blower.

Officials of the Nippon Yusen Kaisha, which company has been maintaining regular service between Seattle and Japan for 30 years, have decided to convert their steamers into oil burners. According to present plans, the trans-pacific liners will be interchangeable, burning fuel oil westbound and coal eastbound. By this arrangement, it is expected that fuel expenses will be reduced and cargo capacity increased.

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Build Ships of Steel Channels

Engineers Have Developed New Method of Ship Construction Which Adds Strength and Saves Weight

SINCE the world's first known shipbuilder, Noah, built his ship of wood, only two principal methods of hull construction, that of wood and the modern construction of riveted steel, have been used. The older or wood construction is still extensively used for river, harbor and canal duty, and many boats are built annually for such work. They are good boats, but not as good as their ancestors because the wonderful oak and white pine timbers are about gone, and the yellow pine and fir timbers are of inferior quality, and higher in price.

Wooden ships, with the exception of those mentioned above, have been almost entirely displaced by those whose outer skin consists of steel plates riveted to frames of various fabricated steel shapes. Although the price is higher, an increasing number of riveted steel vessels find their place each year on inland waters.

Steel vessels of a simple and cheap construction have been desired to replace those now built of wood, and to meet the demands for steel vessels which the future will bring especially on the inland waterways. The Channel Steel Barge Co., Inc., Rome, N. Y., has made a significant stride in this direction, in developing its patented system of channel steel construction for such work.

The principal feature of the channel steel system is that the outer skin of the vessel is made entirely of standard steel channels which run lengthwise of the hull with the flanges turned upward. A steel channel is a much stronger member than a flat steel plate and it also has about twice the strength of the same weight of yellow pine. The flanges are bolted together with standard iron machine bolts, the spacing of which is governed by the size, type and kind of work the vessel is intended to perform.

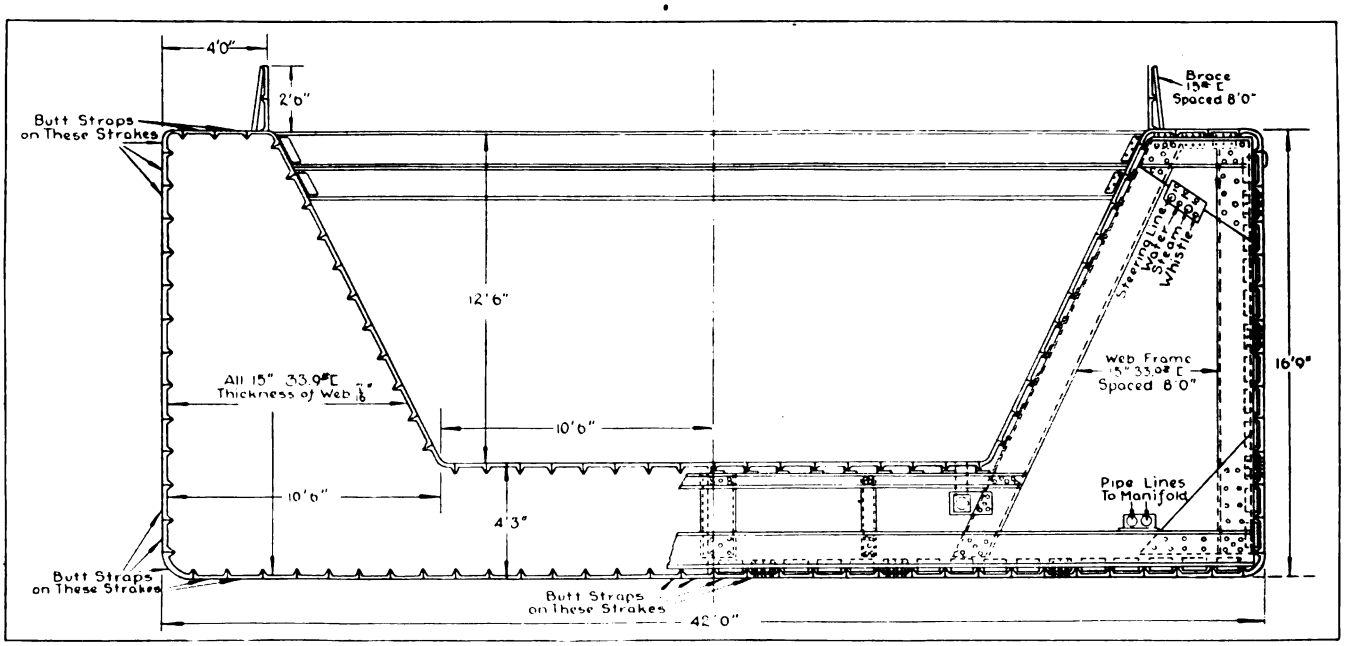
Hull Is Strong

A special felt gasket between the flanges makes the seam permanently air and water tight. The gasket being under great compression, and air and watertight, is subject to but very little deterioration, it being almost impossible to drive a nail into the seam. Should the vessel sustain serious damage, the channel strakes could be removed with but little trouble, and a new gasket put in, or the seam caulked. For oil tight work, the felt gasket is surrounded by a thin metal casing before it is set up.

Transverse frames are used, but are farther apart with the spacing averaging between 8 and 16 feet. No other framing is required, as the flanges of the channels possess great stiffness and form longitudinal girders which run the entire length of the vessel. The enormous strength of a hull built under this system is, therefore, obvious.

The first channel steel vessel was constructed in 1922 and was a hopper bottom sand barge, 116 feet overall length, 22 feet beam, and 10 feet 6 inches molded depth. Her draft complete was 16 inches. The hull, however, was not built entirely of steel, a 6-inch piece of yellow pine planking being between each steel channel with the fastening bolts running entirely through the planking and the flanges of the channels. The special felt gasket was interposed between the channel flanges and the wood member. To test the strength of the barge before launching, all intermediate blockings were removed, as illustrated, and the hull rested on the two end blocks, 95 feet between supports. It stood for 24 hours in this manner without any sign of sagging or buckling. It was then balanced on the midship block and all other blocks removed. It showed no sign of straining or injury after this test. This probably is as severe a test as has ever been deliberately given to a vessel's hull, designed for a commercial purpose.

As all-steel vessels were preferable, the second one built under this system was entirely of steel, with the exception of a wood fender strake interposed between two strakes of steel



CROSS-SECTION OF 200-FOOT, SELF-PROPELLED HOPPER DREDGE BUILT OF CHANNELS, FOR GREAT LAKES SERVICE

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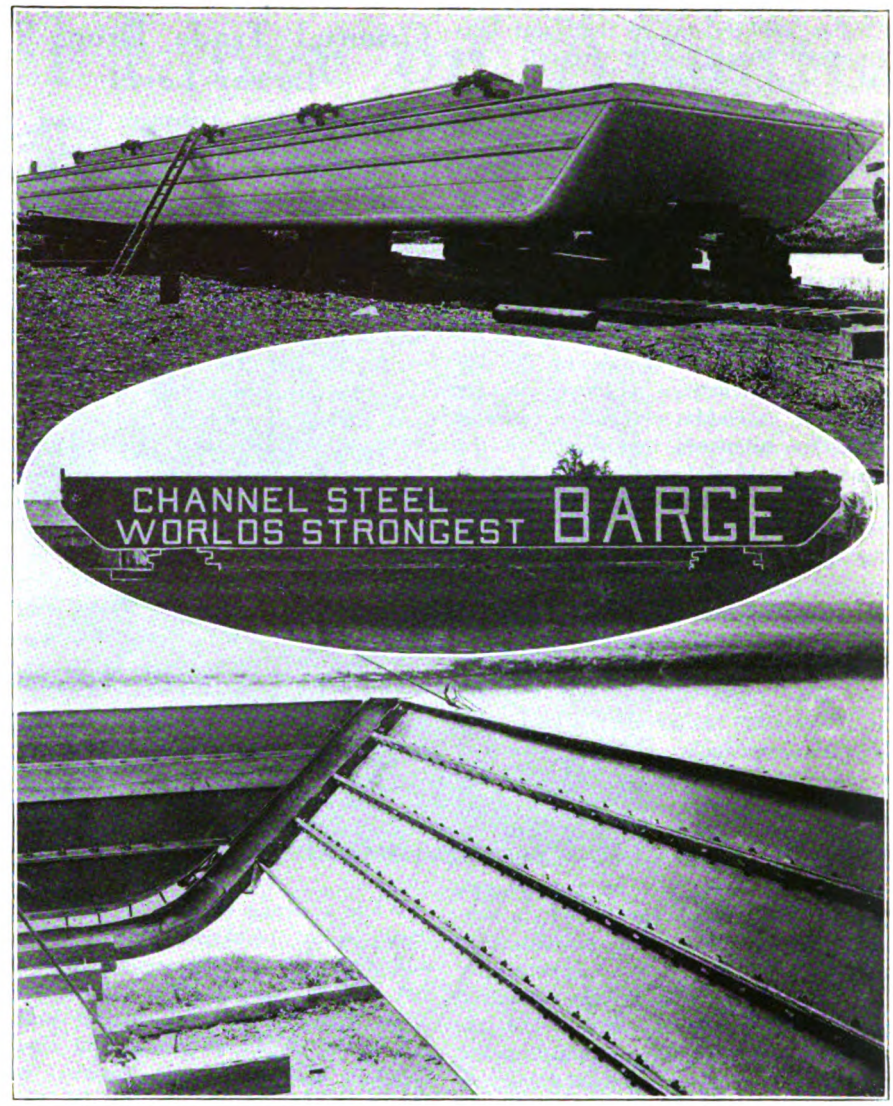
channels. The hopper combing and gunwale strake were also wood. This barge is a 125-yard pocket dump scow, with a trunnel running the entire length of the barge underneath the pocket doors. She was built for the state of New York. She is 100 feet in length, 22 feet beam and 5 feet 6 inches molded depth. The channels used in this construction were 15 inch, 33.9 pounds and those in the hopper sand barge were 12 inch, 20.7 pounds. The frames are spaced about every nine feet and are made up of the same size channels. Bulkheads as usual are located at the ends of each vessel, and at the divisions in the hoppers and tanks, and are also made of steel channels in the same manner as the outer skin.

Both vessels are giving excellent service and more of a larger type will be constructed under this system in the near future.

Designs for two self-propelled hopper dredges or sandsuckers for Great Lakes work have been completed, in which the channel steel system is used throughout, in the hull construction. The vessels are to be built to the American bureau of shipping requirements with a class of 100 C. F. for such work. Each vessel is of the regular lake type with machinery aft, 200 feet overall length, 42 feet beam and 16 feet 9 inches molded depth. The two hoppers in each vessel are open their entire length and width. The deadweight capacity of each vessel is about 2000 gross tons on a 14-foot draft. Approximately 475 net tons of steel is used in each hull. The channels used are 15 inch, 33.9 pounds. Web frames, which are the only frames, are spaced 8 feet, but doubled under machinery spaces and bow. These frames are made up of 15 inch, 33.9-pound channels. These vessels will probably have a speed of 8 to 9 knots, but the type of power installation has not as yet been determined.

Another feature in these vessels, is that but a single row of rivets penetrates the outer skin at only the web frames and bulkheads, and six rivets which secure an inside butt plate, on a few deck and bilge strakes. No rivets penetrate the sides or bottoms of the hoppers, except at the bulkheads and arches. Welding is done away with as much as possible, and is only used to weld seams at the butts of channels, which come well staggered, as 65 feet channels are used, or to weld in and around tapered strakes.

The paramount object of the channel steel construction is to use material



(TOP) 125-YARD POCKET DUMP SCOW BUILT FOR NEW YORK STATE, ON THE BLOCKS JUST BEFORE COMPLETION. (CENTER) FIRST BARGE BUILT UNDER CHANNEL STEEL SYSTEM SUSPENDED ON END BLOCKS, 95 FEET BETWEEN SUPPORTS. (BOTTOM) INSIDE OF HULL, SHOWING CHANNEL FLANGES, BOLTING AND METHOD OF SECURING CORNER CHANNEL IN DUMP SCOW. METHOD OF INSERTING WOOD FENDER STRAKE BETWEEN CHANNELS IS SHOWN

of uniform size, weight and shape so far as it is possible, but only where practical. The construction is simplified as much as possible, in order that a low construction cost may be obtained, and a strong and efficient vessel turned out. Designs for larger vessels will probably be introduced in the near future.

The Channel Steel Barge Co., Inc., is equipped to build larger vessels under this system, but owing to the size of the New York state barge canal locks, the low overhead clearances and the draft of water, the size of vessels is restricted. The maximum size would be about 300 feet overall length, 44 feet extreme breadth, and 24 feet molded depth.

Advantages claimed for the channel steel construction are:

1. Construction cost is less than other steel vessels of same type and dimensions of approved construction.

2. Stronger than other steel ships of same type, dimensions, material and weight, and even stronger than vessels of greater weight having same dimensions.

3. Vessels built under this system generally carry more tonnage on a given draft of water than other vessels of same type and dimensions, as less steel is generally used in their construction.

4. Repairs can be made cheaper and quicker than is customary under the present systems of steel construction.

5. As only a single row of rivets penetrates the outer skin of the ship at each web frame and bulkhead, it is obvious there is but little chance of a vessel leaking even by coming against docks or lock walls, or through the shearing of these few rivets.

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This is unlikely due to the great longitudinal strength. In vessels for rivers, harbors and canals, no riveting is necessary through the outer skin.

6. A certain amount of flexibility is obtained in the longitudinal seams and where no rivets are present to work loose or shear. The spacing of the iron bolts and the felt gasket between the flanges of the channels permit of this small amount of flexibility. On a test recently made by the Lebanon Iron Works, of the ¾-inch by 2-inch iron bolts which are used, the maximum elongation came at 13,250 pounds, and they broke in the threads at 16,000 pounds. More than 500 pounds pressure per square inch can, therefore, be obtained against the flanges of the channels and felt gasket, which form the seams, without undue strain on the bolts. This is, however, more compression than is actually required.

7. The outer skin of the channel steel vessels is far less subject to indentations, such as occurs between frames in plated ships.

8. As no rivets penetrate the sides or bottoms of the cargo holds or hoppers, this is a distinct advantage in carrying either wet or dry cargoes. Where clam shells are used in unloading, no rivets are present that can be started.

9. Vessels may be easily fabricated and shipped knocked down, to remote places and there put together without requiring a plant and but little skilled labor.

10. The channel steel system is particularly adapted for inland waterway vessels of any type, and small steamers or motorships operating on the Great Lakes and coast.

New Ship Board Members

Frederick Thompson, Bert E. Haney and William S. Hill have been confirmed and sworn in as members of the shipping board. The first two were renominated. Commissioner Hill has taken office as the representative of the interior. Former Chairman Farley ended his connection with the board late in January.

Vancouver, B. C., has forged to the front as the leading grain export port on the north Pacific. During 1923, the British Columbian port shipped 24,667,017 bushels of wheat as compared with 22,735,546 bushels from both Puget sound and Columbia river. Export facilities at Vancouver are still unequal to the demand and during January many grain steamers were delayed awaiting their turns at the grain chutes.

Oriental Trade Drops to Lower Level

Due to falling exchange, buying in Japan and China has decreased materially during the last month and a consequent weakness has arisen in transpacific rates. This is especially true of lumber although grain and other commodities are similarly affected. During the last 30 days, lumber freights have dropped from an average of $16 to $13.50 and $14. Many charterers find themselves with high-priced tonnage under commitment while exporters are compelled to cancel space contracts. This is because buyers in the Orient are unable to confirm their letters of credit for orders placed on this side.

This condition has resulted in some serious losses among charterers and shippers. Tramp tonnage is offering freely with little demand. For full cargoes of wheat and flour, steamers can be obtained for $6.25 to Japan and $6.75 to north China. Practically all the lumber now moving to Japan is consigned to the Japanese government as private firms have requested that shipments be delayed as long as possible. Congestion at Japanese ports has aggravated the situation.

While a strong demand exists for full cargo wheat tonnage to north Europe and the Mediterranean, vessel owners are not taking keenly to this business. As a whole they prefer to keep their steamers in the Pacific as the general expectation is that the Japanese business will revive shortly and transpacific rates will again advance. Grain rates are fairly strong at 37s 6d to United Kingdom-Continent and 42s 6d to French Mediterranean and Italian ports.

A marked revival enlivens the intercoastal lumber movement since a month ago during which time rates have advanced from $11 to $13. The conference lines agreed to advance the rate to $12 on Jan. 1 and they have been able to hold at this level. For March, some operators are talking of a $14 rate. Shippers have been seeking outside tonnage for full cargoes but owners have not been attracted by going rates. The situation on the coast to coast berth has been improved by the withdrawal of considerable tonnage.

In other directions, little animation is found in the north Pacific charter market. Southern California is showing a minimum of interest in north coast lumber and rates are weak at $7. Australia is buying sparingly in the market, lumber rates being about $15.50. Sail tonnage is offering freely but practically no demand exists for sailers.

The seven passenger liners bought by Capt. Robert Dollar from the shipping board were originally in the "State" class. The present and former names follow: PRESIDENT ADAMS was the CENTENNIAL STATE; PRESIDENT GARFIELD was the BLUE HEN STATE; PRESIDENT POLK was the GRANITE STATE; PRESIDENT HARRISON was the WOLVERINE STATE; PRESIDENT MONROE was the PAN HANDLE STATE; PRESIDENT VAN BUREN was the OLD NORTH STATE and PRESIDENT HAYES was the CREOLE STATE. Most of them have been continuously in the north Atlantic trade although the PRESIDENT HARRISON and the PRESIDENT HAYES ran for a time between San Francisco and Calcutta and later between Seattle and Buenos Aires.

U. S. Shipping Board Vessel Sales

NEUSE, ex-enemy cargo, 6890 deadweight tons, 4496 gross tons, built in 1900, purchased by Boston Iron & Metal Co., Inc., Baltimore.

WACHUSETT, ex-enemy cargo, 6160 deadweight tons, 4336 gross tons, built in 1896, purchased by Boston Iron & Metal Co., Inc., Baltimore.

ANDALUSIA, ex-enemy cargo, 7475 deadweight tons, 5509 gross tons, built in 1896; BLACK ARROW, ex-enemy combination passenger and cargo, 7050 deadweight tons, 6022 gross tons, built in 1901; PHILIPPINES, ex-enemy cargo, 13,312 deadweight tons, 11,440 gross tons, built in 1898; WEST EAGLE, steel cargo, 8688 deadweight tons, 5690 gross tons, built in 1918; WESTERN COMET, steel cargo, 8594 deadweight tons, 5871 gross tons, built in 1918. All these, purchased by H. L. Crawford & Co., New York, are classed as obsolete or damaged and must be scrapped within one year.

AMPHION, ex-enemy passenger and cargo, 8970 deadweight tons, 7409 gross tons, built in 1899; ASCUTNEY, ex-enemy cargo, 6450 deadweight tons, 4066 gross tons, built in 1896; MERCURY, ex-enemy passenger and cargo, 10,350 deadweight tons, 10,980 gross tons, built in 1896; NANSEMOND, ex-enemy passenger and cargo, 15,002 deadweight tons, 13,332 gross tons, built in 1896; VON STEUBEN, ex-enemy passenger and cargo, 6900 deadweight tons, 14,908 gross tons, built in 1901—these are damaged or obsolete ships purchased by Boston Iron & Metal Co., Inc., Baltimore, under contract to scrap within one year.

HUGENOT, steel tank steamer, 10,387 deadweight tons, 6964 gross tons, bought by Bernuth Lembcke Co., Inc., 171 Madison avenue, New York.

WYANDOTTE, ex-enemy cargo ship, 5700 deadweight tons, 4761 gross tons, built in 1894; ARMENIA, ex-enemy cargo ship, 6982 deadweight tons, 5463 gross tons, built in 1896; COOSA, ex-enemy cargo ship, 2625 deadweight tons, 1969 gross tons, built in 1896—these are damaged or obsolete ships purchased by Union Shipbuilding Co., Baltimore, under contract to scrap within one year.

Expenditure of $2,000,000 in the construction of the first unit of its $4,000,000 water terminal at Seattle is announced by the Pacific Steamship Co. Work will be begun in the near future on the largest freight shed in Seattle, its dimensions being 1000 feet by 160 feet in width. The completed improvement will include offices for the various departments of the company as well as modern piers equipped with up to date facilities.

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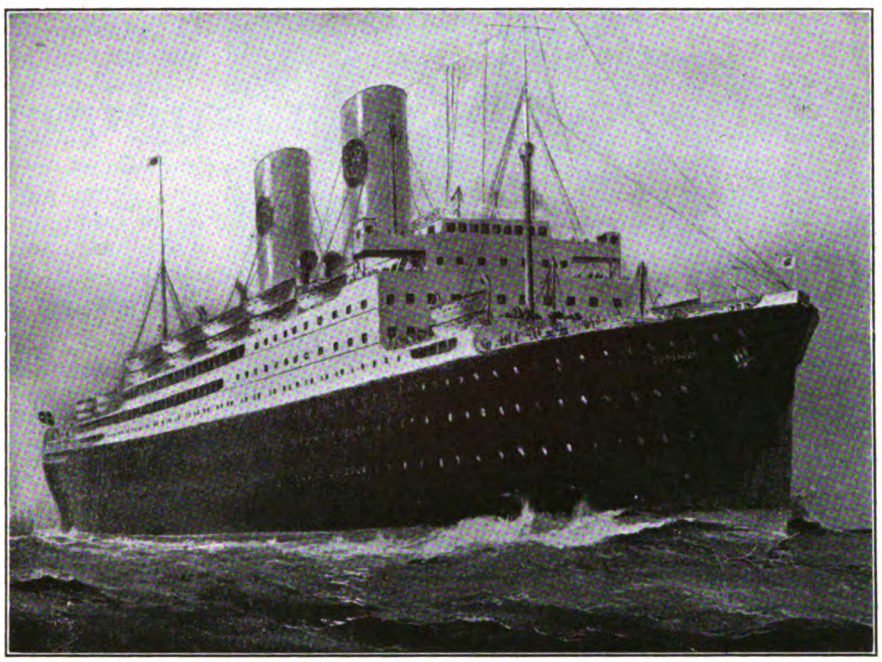
First Diesel Liner on Atlantic

Motorship Gripsholm Building for Swedish American Line Is First of Her Type for Transatlantic Passenger Trade

FAITH in the successful performance of oil engines some 50 per cent larger than any so far used to propel ships is shown by the Swedish American line in deciding on this type of main drive for its new passenger liner, the motorship GRIPSHOLM now building at the yard of Sir W. G. Armstrong, Whitworth & Co., Newcastle-on-Tyne, England. This vessel will be ready for service early in 1925. Before going to a more detailed description, the principal characteristics of the hull and motive power are as follows:



GRIPSHOLM, FIRST DIESEL LINER IN NEW YORK-EUROPE ROUTE

PASSENGER MOTORSHIP GRIPSHOLM

Hull—	
Length, feet, inches	574 6
Breadth, feet, inches	74 0
Depth, feet, inches	76 6
Draft, feet, inches	29 0
Gross register tonnage	17,000
Displacement tonnage	23,500
Twin screws.	
Speed in knots	17
Passenger capacity—	
First class	162
Second class	162
Third class	1018
Total	1661
Machinery—	
Main engines—Burmeister & Wain.	
Two—double acting diesel type—total brake horsepower	13,500
Four-stroke cycle.	
Brake horsepower each	6,750
Revolutions per minute	125
Number of cylinders	6
Cylinder bore in m/m—840: in inches	33.1
Stroke—in m/m—1400: in inches	55.15
Fuel consumption—pounds per brake horsepower per hour	0.38
Estimated fuel consumption in tons per day at 17 knots	60
Auxiliary engines—Burmeister & Wain.	
Six units of a total brake horsepower	3,600
Four-stroke cycle—diesel type.	
Located in a separate engine room.	
Three 6-cylinder units coupled to air compressors, each brake horsepower	700
Three 3-cylinder units coupled to 333 kilowatt generators, brake horsepower	500
Estimated fuel consumption per day for auxiliaries in tons	10

According to the estimate given above a total of 70 tons of oil will be consumed per day while at sea. A fair estimate of fuel consumption in tons per day for a main and auxiliary steam turbine installation of equivalent power in the same ship will give 190 tons. For prices of fuel oil of 16 degrees Baume' and diesel oil of 30 degrees Baume', current in New York during January, 1924, and allowing for the difference in specific gravity of these oils, the daily cost for fuel used while at sea would be as follows:

Oil engine installation as above—70 x 7.32 x $2.10 = $1076.

Steam turbine installation of equivalent power—190 x 6.69 x $1.415 = $1799.

This represents a saving of $723 per day at sea, or over $5,500 for a voyage between Gothenberg and New York. In the same way, while in port the fuel cost per day will be:

Oil engine installation—10 x 7.32 x $2.10 = $154.

Steam turbine installation of equivalent power—27 x 6.69 x $1.415 = $256.

Which represents a saving of $102 per day while in port.

On the assumption that repairs will be no greater than on a steamship and that any saving due to a lesser engine room crew may be offset by extra cost for such items as lubricating oil and additional electricians to take care of the extensive electrical equipment, the above saving in fuel costs should represent the minimum total saving. The increased steaming radius or lesser weight of bunkers necessary is also important and represents a definite saving. Applying the above estimated saving in fuel costs to a tentative performance of this ship for one year: At sea—187 days @ $723 per day, $135,201. In port—121 day @ $102 per day, $12,342. Lay up—57 days @ $51 per day, $2,907. Total saving for one year, $150,450. This sum will pay the interest at 6 per cent on a capital outlay of $1,571,865, plus depreciation to the same amount in a period of 20 years, allowing for interest at 4 per cent per annum. As a ready calculation, the interest return on the regularly deposited depreciation fund is calculated at 4 per cent for 10 years on the entire sum of deposits made throughout the 20 years. Considering, therefore, the single item of fuel costs of operation, and with the sum total of all other operating costs on a parity, the saving due to oil engine drive over steam drive, even allowing for a considerable increased capital outlay is startling and will give such a ship a tremendous advantage over similar, steam driven ships.

So far this discussion has been confined to a direct saving, based on the well known great economy in fuel consumption of the oil engine. Other important considerations favor this type of motive power. A much greater latitude and freedom of choice in the layout of special features, public rooms and passenger quarters is possible. The actual space needed for the main and auxiliary engines is less than the combined engine and boiler rooms on a steamship. Particularly important is the saving in space due to the elimination of uptakes and stacks as such. Also as the oil engines do not radiate heat to any inconvenient degree, passenger quarters are located clear across the ship on the three passenger decks in way of the engines. These quarters, it is

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NEW HOME OF MATSON NAVIGATION CO. A HIGH SUCCESSFUL AMERICAN SHIPPING COMPANY WHICH OPERATES BETWEEN PACIFIC COAST AND HAWAIIAN ISLANDS

claimed, will be just as cool and comfortable as in any other part of the ship. Additional space will make possible a swimming pool. The third class accommodations will be exceptionally good, many of the cabins are to be fitted with only two berths. No dividing barriers will be set up for the second class passengers, and they will have a round the ship promenade for themselves.

Though not necessary for their original reason, this ship will have to all outward appearances two regulation stacks. So ingrained is the association of large funnels or stacks particularly with passenger ocean going ships, that to avoid a freakish appearance it was decided to use them. Their particulars are interesting. The exhaust from the engine will be carried up in a comparatively small diameter pipe in the rear funnel. No dust, soot or cinders will inconvenience the passengers. The rear funnel will also contain an elevator shaft for conveying the engineers from the engine room to their quarters on the top deck.

In this connection, it may be said that providing comfortable, airy pleasant quarters for the engine room staff on the top deck is of the utmost importance. American shipowners and naval architects should give greater consideration to crew quarters and particularly to the location of the engineers' quarters so that they are as comfortable as possible and situated in pleasant surroundings. Engineers have as a rule always fared a poor second best as regards accommodations on American ships.

A service food elevator and pantry for deck officers and engineers will be located in the forward funnel, so that food may be served to them hot from the galley. This arrangement will eliminate the running about decks and up and down stairs in a tossing sea, of waiters carrying trays of food. Ventilator shafts will also be installed in both funnels. In this ship, steam is completely eliminated. Electricity generated by means of oil engines reigns supreme, and will perform all lighting, heating and ventilation of cabins. Even the galley will be operated by electricity. All auxiliaries on deck such as winches, windlass, capstans and steering gear, and all pumps and other auxiliaries below deck will be electrically driven.

Throughout, the motorship GRIPSHOLM has been designed to include the most modern conveniences for the accommodation of her passengers. Her entry into service will mark the introduction of oil engines for transatlantic passenger liners, and her performance will be watched with the greatest interest by shipowners and their technical advisors.

16-Story Home of Matson Line Is Completed

Standing as a monument to Capt. William Matson, founder of the Matson Navigation Co., which operates a fleet of 15 ships from San Francisco and Puget sound to the Hawaiian islands, the new Matson building, located at Market and Main streets, San Francisco, was formally opened on Jan. 17, when the Matson line moved from its old location, 120 Market street. The new address is 215 Market street.

One of the distinctive features of the new Matson building is its exterior decoration. A marine motif has been carried by the architects, Bliss & Faville, San Francisco, who have employed effectively conventionalized forms of sea life and ships' gear reproduced in terra-cotta. These decorative forms include representations of dolphins, sea shells, Neptune's tridents, anchors, ship's lines while a viking ship model over the main entrance symbolizes the life and achievements of the late Captain Matson, descendant of the Vikings. He died Oct. 11, 1917, but his ideals live today in the Matson line.

The Matson organization's new home also houses the McCormick Steamship Co., the American-Hawaiian Steamship Co., the Bethlehem Shipbuilding Corp. and a number of Hawaiian firms' San Francisco offices. The structure is 16 stories high and represents an investment of more than $2,000,000. Two years were consumed in its construction.

Captain Matson founded the Matson line back in 1882 with one schooner, a 200-ton craft, the EMMA CLAUDINA. Today the Matson fleet numbers 15 ships, of which six are passenger liners and nine cargo steamers. Construction of a fast express liner with a speed of 22 knots to make the 2091 mile voyage from San Francisco to Honolulu in 4½ days against the present fastest time of 5 days 22 hours, is now contemplated.

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Contracts To Build Six Fuel Oil Barges

The Bethlehem Shipbuilding Corp. contracted in January to construct at its Sparrows Point, Md., plant, six steel barges for the Standard Oil Co. of New Jersey for use in Ohio river service. Three of the barges will be towed to the Ohio river from the Sparrows Point plant on April 2 and three on May 2. The journey down the Atlantic coast, up the Mississippi and Ohio rivers is about 6000 miles. The barges are propelled by fuel oil engines and embody everything that is up-to-date for river service. They will carry 2000 barrels of fuel oil in bulk, and a deadweight of 290 tons.

Correct Fuel Consumption

Several readers have called attention to a mistake made in the data given in the January issue descriptive of the new Bethlehem oil engine. On page 25, the fuel consumption in pounds per brake horsepower per hour was given as 0.025. This should have been 0.425.

Seek Economical Winches for Motorship

IN A ship's equipment, no part can do more to break or make the good reputation of a ship than the hoists or winches with which cargo is loaded and discharged. Trouble enough has been experienced with inefficient and poorly designed and cheaply constructed steam winches, but on the whole steam hoists, which have been standard equipment ever since steam was first used on ships, are considered reliable and effective though wasteful of power. Not so long ago, the diesel type of engine came into use here and there for the main drive of new ships and was substituted in some cases for the steam drive in existing ships, with the deliberate purpose of greatly reducing the fuel consumption. In new ships, the use of diesel engines practically precluded the use of steam for auxiliaries. In conversion jobs, a portion of the existing boiler plant could be left intact, and the temptation in specific instances was strong to do so, as the owners felt that a considerable saving in initial cost would result by keeping the original engine room and deck steam auxiliaries. In the cases where the latter course was adopted, however, the fuel costs for all purposes were found to be from 50 per cent to 75 per cent greater than in complete diesel installations using electric motor drive for the auxiliaries.

Perhaps in no field of endeavor where mechanical appliances are used is there more conservatism in adopting new devices than in the merchant marine. As a rule, with notable exceptions, shipowners feel that they can not afford to experiment. A demonstration of mechanical perfection is not sufficient, it is necessary to show an installation on a ship in operation and to support claims for its quality by its actual performance. Coincident with the introduction of the diesel for the main drive, engine room and deck auxiliaries were developed using electricity for motive power. The ordinary steam driven pumps and hoists were of course originally designed to accommodate reciprocating steam action. When steam is used in a rotary manner, as in the turbine, its application to pumps for instance completely changed the principles of design of the pump end. So far there has been no indications of attempts to redesign the auxiliary machinery to specifically accommodate the rotary action of electric motors. The design of the functional end of auxiliaries customarily driven by reciprocating steam action has as a rule remained the same where electric motor drive has been applied.

FIG. 1—MAIN DECK WINCH DRIVEN BY 25-HORSEPOWER MOTOR

One of the most recent installations of electric motor driven winches is that shown in the accompanying illustrations, Fig. 1 and 2, on the motorship SUPHENCO. Eight of these winches were installed on the main deck and two smaller ones on the bridge deck, two for each hatch, one arranged right hand and one left hand.

Design of Electric Winch

To insure a successful electric winch the quality of three important elements enters into the design and construction.

1.—The winch proper, frame, drum, warping head and its shaft and bearings and the gearing.

2.—The watertight electric motor.

3.—The electrical controls for operating.

The winch proper was designed and built by the Lidgerwood Mfg. Co., New York, a concern of long standing, holding an enviable reputation for steam winches of excellent design, good material and workmanship. A single drum and single winch head are keyed to the main shaft and driven by an electric motor through a double reduction of spur gearing as shown in diagram, Fig. 3. The ratio of gears at the motor are cut and the pinion is forged steel while the gear ratio at the drum is cast iron and machine molded. Where extra quiet running is desired as on passenger ships, this ratio also is cut, but the machine molding is good and is entirely satisfactory, for all ordinary installations.

All the gearing is grouped on one side and enclosed in a cast iron casing clearly shown in the illustration. The casing effectively prevents rope from fouling the gears, a source of constant annoyance, delay and expense with exposed gears. The life of the gears is materially increased by protection from the lodgment of foreign material, dust and dirt. Though not watertight, the casing provides a degree of protection against the elements. Any water that does get in is drained off from the bottom of the casing. For emergency, a non-burn lined band brake operated by a foot lever is fitted. This

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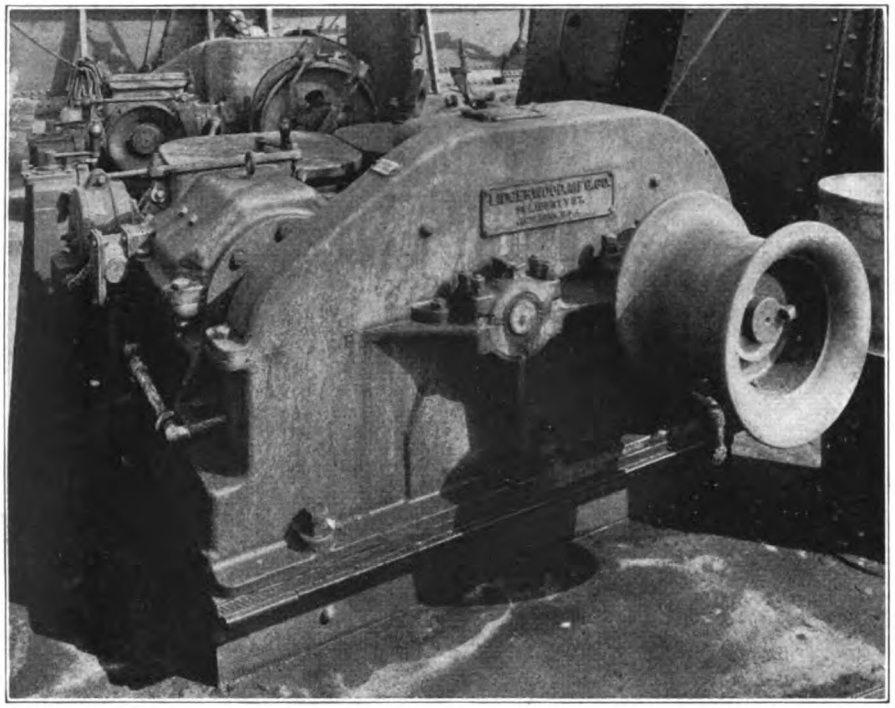

FIG. 2—ANOTHER VIEW OF SAME TYPE OF MAIN DECK WINCH

brake is not needed for normal operating, the solenoid brake automatically functioning to check or hold the drum stationary as required.

The winch frame and bed is cast in one piece and the motor and solenoid brake are mounted on the bed plate opposite the drum. Foundation bolt holes have been spaced so that they are interchangeable with the standardized steam winches of the same manufacturer, many of which have been installed on both shipping board and privately owned vessels, so that for conversion jobs on vessels carrying such winches, no extensive alteration in foundations are necessary when changing from steam to electric winches.

Some details indicative of the quality of these winches are interesting. The bearing caps are all secured by through bolts provided with lock nuts. All bearings are provided with removable bronze bushings, readily interchanged, and with oil reservoirs and hinged covers. The drum barrel and warping head barrel are turned and polished, thus greatly lessening the wear on the rope used. Both the drum shaft and intermediate shaft are unusually heavy for the size of winch, affording stiffness and greater efficiency.

Electric Motor

It has been fully demonstrated that the electric motor for deck auxiliaries must be of ample power, ruggedly built and absolutely watertight. The electric winches shown in the accompanying illustrations are fitted with 25 horsepower, 550 revolutions per minute, 230-volt, direct current, series wound, watertight, ball bearing motors, designed and constructed by the Electro Dynamic Co., Bayonne, N. J.

These motors are completely enclosed in a substantial watertight casing, with end housings for the shaft designed with a chamber consisting of a series of three annular grooves with a drain back to the bilges, to take care of any water which may enter along the shaft. This chamber is outside of the ball bearings on either end of the motor. The arrangement of the housings effectively keeps any water from the ball bearings and the armature. These bearings are in themselves a good water seal. To test these motors for water tightness, a hose with 30-foot head and a 1-inch nozzle was played all over outside the casing and also parallel to the shaft.

The casing is in two halves and the split comes just above the center line so that the motor may be opened for inspection and repairs, with a minimum disturbance of connections. The coils are impregnated with waterproof composition and varnish. Noncorrodable parts are used throughout. Aside from a gain in efficiency due to easier running, ball bearings have a distinct advantage over sleeve type bearings by eliminating burn outs due to oil lubrication and in absorbing end thrust. Only a small amount of grease is necessary for ball bearings, not for lubrication but to prevent rust. The length overall of a motor running in ball bearings is less by from 15 to 20 per cent than a sleeve bearing motor, a factor of great importance where space is limited.

Conditions of service on ship board for any electrical equipment is particularly severe and for successful results the difficulties must be known in detail and the design and construction of the motor must be such as to eliminate all chance of trouble if real faith is to be established in the product offered. The motors used on these electric winches are the result of long experience and development work on the part of the manufacturers in supplying electrical equipment for service conditions on board ship, particularly for the navy. They may, therefore, be expected to operate continually with a minimum of attention over a long period of time.

An important item in a really practicable electric winch is flexibility of range in load and speed. This is accomplished in the equipment under discussion by the series characteristics of the motor and the gear ratios from the motor to the winch. At full load rating, the motor gives a duty of 4000 pounds at a rope speed of 170 feet per minute while the average load which is taken at 1800 pounds is handled at a rope speed of 225 feet per minute and for lighter loads even faster. The maximum load on a single line at reduced speeds is 7500 pounds. The approximate weight of the winch with motor and solenoid brake, but exclusive of control which is mounted separately in this case, is 6000 pounds.

Electrical Control

Having, with experienced and critical consideration, chosen the winch proper and the electric motor for winch equipment on board ship the problem is not more than two-thirds solved. There remains, in order to secure completely successful outfits of this kind, similar careful study and critical consideration of the third major division, that is the electrical controls. Knowledge of and long experience with the difficulties and problems met in the design and construction and installation of electrical controls under the severe and exposed condition of service on ship board are absolutely essential in producing rugged, practical and successful controls. The Cutler-Hammer Mfg. Co., Milwaukee, supplied the controls for the electrical winches shown in illustrations, Figs. 1 and 2. This company has specialized in the design and construction of controls for electrical machinery with specific applications to such equipment on ship board both in exposed positions on deck and below decks.

Broadly speaking, two types of controls are used, one manual, the other automatic. In the manual control, the contacts for supplying current to the motor from zero to full load is made directly by moving the drum controller handle while for automatic control the master controller moved by hand actuates the application of a pilot or relay current

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which in turn operates an automatic control, located below decks, or at any other distant protected point. As a finished electrical control, the latter is mechanically the superior method, and the flexibility, smoothness and rapidity of control of the winch both loaded and light is greater. However, manual control is a less expensive installation, somewhat simpler and perhaps a little easier to understand and to take care of by men with only slight electrical knowledge. In this particular installation, the manual type of control was used.

The accompanying illustrations show this special watertight drum type of manual control with overload and no voltage protective panel, and grid resistance enclosed in a watertight box arranged so that it may be opened for ventilation while the winch is in operation, and also a watertight solenoid shoe brake, for each winch.

Dynamic Braking Used

The winch is operated entirely by moving the controller handle in one direction for hoisting and in the other for lowering the load. In lowering, with no load, the motor functions as a motor. With load, the motor functions as a generator and by converting the power developed by gravity on the load into electrical energy, acts as a brake or cushion and thus regulates the speed of lowering the load. This is known as control or braking on the dynamic principle. If the controller handle is in the neutral position, the solenoid brake sets and the load may be held suspended at any position.

This brake is of simple and rugged construction, and absolutely waterproof. The magnet armature is part of one of the brake shoes while the magnet field is connected to the opposite shoe arm by a rod, Fig. 1, which passes over the brake wheel. With no current on, the magnet field, of course, does not exert any attraction on the armature and the heavy coiled spring between these two respective parts exerts its full pressure to separate them. In so doing, this sets the two opposite brake shoes against the wheel on the motor shaft, holding the motor stationary. As the current is thrown on by the controller handle for operating the motor, the magnet field is excited by the current passing through it and thus tends to bring the magnet armature and magnet coil toward each other and so releases the pressure of the shoes on either side against the wheel leaving the motor free to rotate.

Keeping in mind that the solenoid brake sets at once automatically when the current is shut off, failure of the current for any reason or an overload on the line, as for instance if the cargo hook or load should catch on the hatch coaming, causes the current to be immediately shut off, by means of the overload and no voltage panel and the load is held in position. If the current is shut off due to motor overload, power may be restored upon returning the controller to neutral and starting over again.

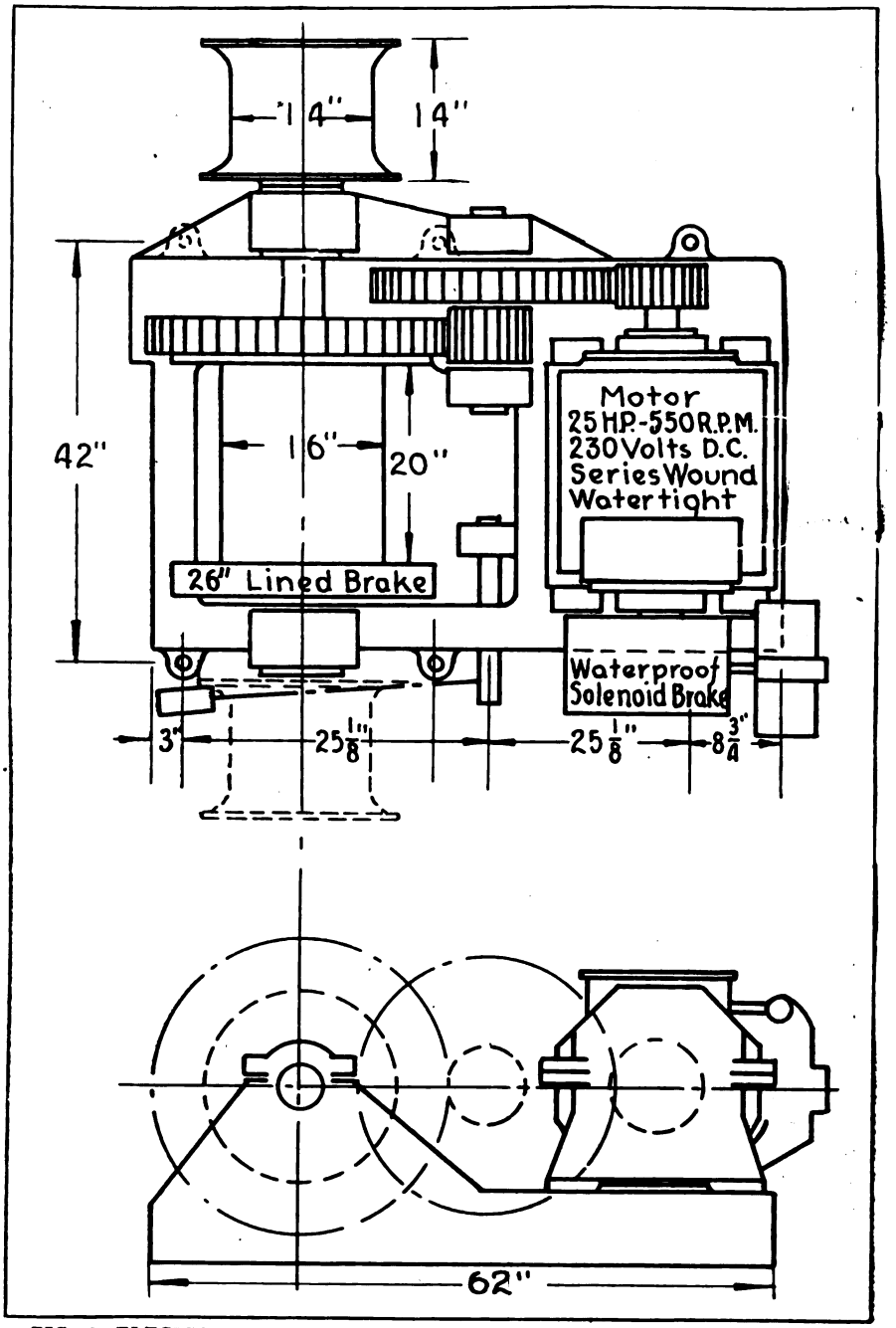

FIG. 3—ELECTRIC CARGO WINCH INSTALLED ON MOTORSHIP SUPHENCO

It is fundamental and it cannot be stressed too much that machinery and equipment on board ship, especially on deck should be simple, rugged, impervious to wind, weather and sea and also fool proof. A ship in the course of its career must often work its machinery under anything but ideal conditions. In bad weather, some times at night, often with inexperienced operators, ships must be loaded and discharged. A winch operator is not an engineer and as a rule has only the merest rudiments of knowledge concerning the machinery he operates. A description in detail has been given here of these winches as a record of a recent installation on a full diesel ship with electrical auxiliaries so that this information may help in the choice, and improvement of future installations. From this and other recent installations, it will be noted that steady progress is being made to improve the design and construction of electrical auxiliaries for ship use. It may also be pointed out that the American Institute of Electrical Engineers, issued under date of December, 1920, a set of "Marine Rules" which serves as a useful guide in the construction and installation of electrical apparatus on ship board. Steps are now being taken to have these rules and regulations adopted as an American standard for marine practice.

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Develop Big U.S. Diesel Engine

Engineers Bring to Operating Stage Powerful Oil Engine of Original Type—Details of Prime Mover

DIESEL engines for ship propulsion are the main subject of discussion when ship owners, ship builders or engine designers get together. This country has lagged back in the development and use of such engines but their greater use is insured by the increased attention they are attracting. Foreign, particularly European, progress in diesel engine design and use has been ahead of American. In an original analysis published on page 24, January issue of MARINE REVIEW, the causes are given. They show also that the average American installation of oil engines carries less power than foreign units.

For these reasons, especial interest has been drawn to the work of the Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa., in developing a powerful oil engine of American design and manufacture which is adaptable for ships of any size. The January article discussed the general features of this engine. The following gives additional information obtained from the company's engineers and has timely value owing to the sea trials on Feb. 8 of the big motorship CUBORE, which is equipped with this new engine. The Bethlehem oil engine is of the vertical, 2-stroke cycle, single-acting type and is constructed in units of four, six, or eight cylinders. It runs at a speed of from 116 revolutions per minute for land power and twin screw marine purpose down to 90 revolutions per minute for single screw marine use. The number of power impulses given to the crankshaft per revolution is equal to the number of cylinders, thus giving a more even turning torque than would a 4-stroke cycle engine. The effect of this regularity of turning moment in marine service is illustrated by the case of the motorship CUBORE, which is equipped with a 6-cylinder, 2-cycle Bethlehem oil engine developing 2500 shaft horsepower, at 90 revolutions per minute. This engine operates at all speeds down to 20 revolutions per minute and under all marine conditions without the aid of a flywheel. The company engineers sought this regularity of turning torque which has particular advantages in a marine installation since it permits a reduction in the size of the line, thrust, and propeller shafts. This is important in the conversion of ships from steam to oil engine drive since in most cases installation can be made without having to increase and, therefore, renew the line, thrust, and propeller shafts already in the ship.

The scavenging air is admitted through one valve in the top of the cylinder, and the exhaust gases pass out through a ring of ports extending entirely around the circumference of the lower end of the cylinder. In carrying out their work the designers sought to create an engine in which all parts subject to flame temperatures would be so designed as to be able to resist successfully for an indefinite time the combination of temperature and pressure stresses inseparable from the operation of oil engines under heavy load.

To accomplish this object, the power cylinder was designed as indicated in Fig. 2 and in the section through the engine, Fig. 1. The inner and outer cylinder walls are united only at the top and at a point entirely removed from the heat of combustion. By means of the flanges shown, the cylinders are mounted in pair, in a casting designed to receive them. The power cylinder projects downwardly through this casting, to which it is attached only at the upper flange. Consequently the cylinder is free to expand in all directions without setting up stresses in any working part. Since the inner and outer cylinder walls are only attached at the upper end, it is evident that these walls may expand at different rates without setting up any temperature stresses in the power cylinder. In any internal combustion engine, the inner cylinder wall is subjected to flame inside and water outside, and the outer cylinder wall is subjected to water temperature inside and engine room temperature outside so that it is evident such differential expansion between inner and outer walls must inevitably occur. These expansion differences increase as the stroke and consequent length of power cylinder increases. The construction of the Bethlehem engine is carefully planned to avoid trouble from this source. As shown, the cylinder is cast with the water jacket space very open and accessible. This opening in the outer jacket wall is closed by a light cast iron sleeve attached to the power cylinder at its upper end by a flange and provided at its lower end

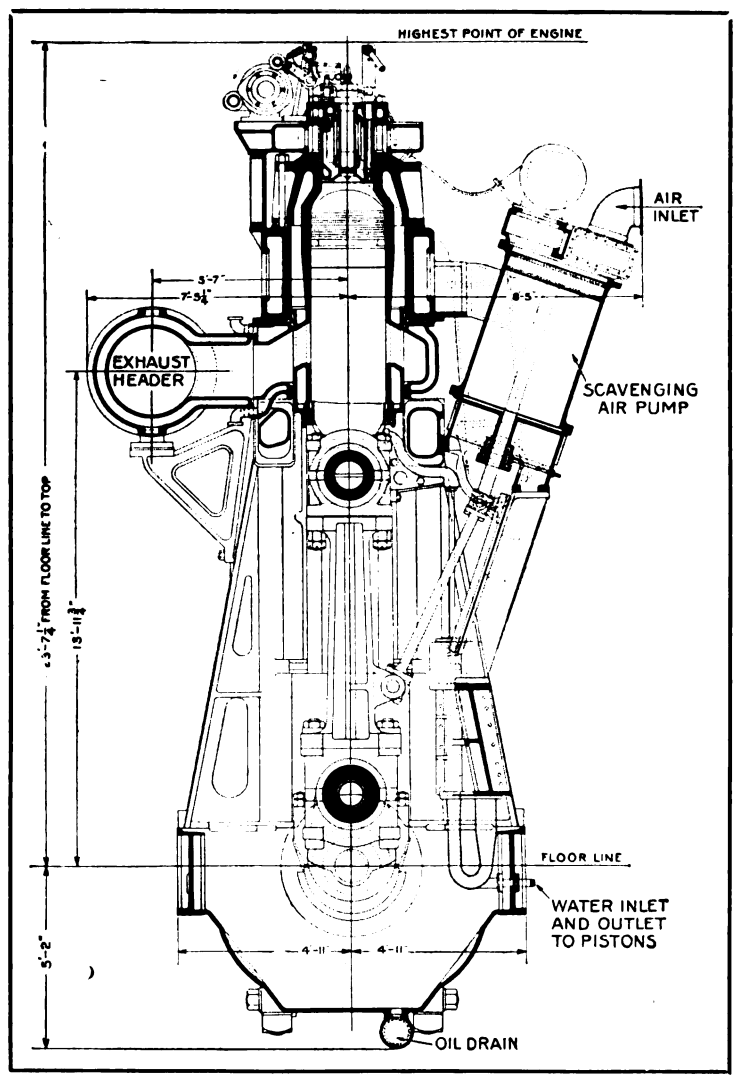

FIG. 1—SECTIONAL DRAWING OF NEW OIL ENGINE

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with a water joint permitting axial expansion without danger of leakage. This sleeve is shown in Fig. 1. This cylinder construction permits the cores to be accurately supported and provides for the adequate inspection and cleaning of every square inch of the water jacketed surface.

Exhaust ports are cast integrally with the cylinder barrel, thus avoiding any joint between the cylinder barrel and exhaust ports. Such a joint, if present, would have to hold hot gases on one side and water on the other.

As shown in Fig. 1 the cylinder is

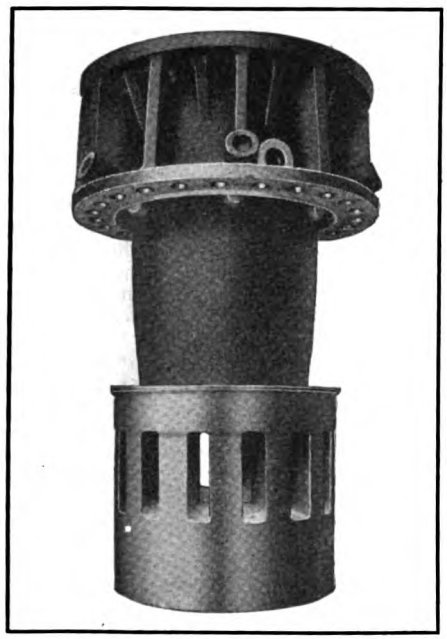

FIG. 2—POWER CYLINDER

held down to its cylinder support by studs passing through the two upper cylinder flanges. The combustion pressure in any power cylinder is exerted downwardly on the piston and upwardly on the cylinder. In this type, such pressure passes directly to the cylinder flanges and studs and so to the cylinder support, which is held down to *A* frames and bed-plate. With the construction shown it is evident that no axial tension stresses whatever pass through the cylinder barrel or exhaust ports so that all danger of the cylinder castings being cracked due to the working stresses set up by the explosion pressures is eliminated.

Passing Heat From Cylinders

The preceding paragraphs describe how the designers sought to avoid stresses due to temperature and axial stresses due to combustion pressure in cylinder. This pressure also produces stresses tending to burst the cylinder. These bursting stresses can not, in an internal combustion engine, be safely reduced by increasing the thickness of the cylinder walls, because each square inch of the wall, particularly at the upper end of the cylinder, must pass a large amount of heat to the water jacket in a short space of time. The greater the wall thickness, the greater the consequent difference between the temperatures of the inside and outside surface of the cylinder walls. The greater such difference in temperature, the quicker a cylinder will fail, due to heat fatigue.

The practical success of an internal combustion engine depends upon the avoidance of such heat fatigue stresses, and the necessity of care and skill in the design of cylinders naturally increases with their size, since thickness of walls must increase with the diameters of power cylinders. To cover this point, the Bethlehem power cylinder has been designed as shown in Fig. 1. The upper part of the cylinder is contracted from diameter of the bore to that of the inlet valve cage. This form was chosen, as compared to an open ended cylinder, greatly to increase the strength of the cylinder without necessitating an increase in the thickness of the cylinder walls. The cylinder wall thickness is uniform in all that portion of the cylinder subject to maximum temperature and pressure, the wall thicknesses decreasing with the lower pressures in the lower part of cylinder. Such uniformity in section causes uniform change in shape when heated.

The part of the cylinder subject to greatest heat is that portion between the lower end of the inlet cage down to that portion of the cylinder wall covered by packing rings when the piston is at or near top center. This portion is efficiently cooled by the water jacket, which extends to a point of the cylinder wall above the bottom of the inlet cage. The hot cylinder walls are not only cooled by water but also are cooled on the inside surface by the scavenging air. This enters through a mushroom shaped scavenging valve. The shape of the cylinder is so designed that the incoming current of scavenging air passes directly along this heated wall surface, thus absorbing from it a material amount of heat in addition to that passing to the water jacket. Cooling done by the scavenging air not only helps to maintain the cylinder wall at a safe temperature, but increases the efficiency of combustion, since all the heat absorbed by the air from the cylinder walls is added to the working cycle of combustion.

The only other parts exposed to maximum temperature and pressure are the power piston, inlet cage, scavenging valve and fuel valve. Of these, the piston, inlet cage and fuel valve are water-cooled, while the scavenging valve is cooled by the incoming scavenging air. During more than three years operation of these engines at heavy loads, no ill effect due to heat on these parts has been found.

Action of the Engine

All working parts except the piston, necessary for the operation of a power cylinder, including the fuel valve, scavenging valve, air starting valves and relief valve, are contained in a single compact and easily removable cage, shown in Fig. 3.

To trace the action through the engine of the pressures generated by com-

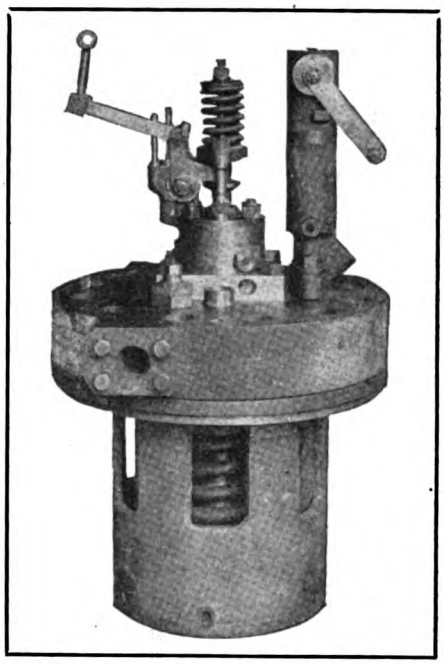

FIG. 3—SIDE VIEW OF VALVE CAGE

bustion, start with the piston on top center, at which point atmospheric air has been compressed to about 450 pounds per square inch. Into this compressed air, and in the axis of the power cylinder, a charge of fuel is blown by means of injection air in such a way as to secure thorough atomization of the fuel, which in its finely divided state is ignited by the heat due to compression of the air in the cylinder. Pressure is thus generated, not instantaneously, but at a rate proportional to that at which fuel is introduced. This pressure is transmitted downward to the crankshaft and bedplate through the piston, piston guide, crosshead and connecting rod. The pressure which acts downwardly on the piston also acts upwardly on the cylinder, thus being transmitted to the cylinder support to which the cylinder is bolted. This cylinder support contains a pair of power cylinders and rests on three A-frames, to which it is rigidly held by six long bolts passing from the top of the cylinder sup-

(*Continued on Page* 104)

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Late Decisions in Maritime Law

Legal Tips for Shipowners and Officers

Specially Compiled for Marine Review

By Harry Bowne Skillman

Attorney at Law

IN CONTRACTUAL towing cases, the tug owner is not denied limitation of liability unless he personally sanctions starting out of the tow under adverse conditions. Where it appears that a private vessel, as a launch, is properly manned and equipped at the time of the accident, and the injury occurs without the owner's privity or knowledge, he may be liable for the same only to the extent of the value of the vessel. Under the act of congress (Revised Statutes, section 4283), he is only chargeable for his wilful and negligent acts, and the negligence of those in charge of the navigation of the vessel, to which he was not privy and of which he had no knowledge, will not be imputed to him. * * The knowledge or privity that excludes the operation of the statute must be in a measure actual, and not merely constructive. It must be actual, in the sense of knowledge or authorization, or immediate control of the wrongful acts or conditions, or through some kind of personal participation in them."—ONEIDA, 282 *Federal Reporter* 238.

* * *

The charter involved in the case of Oneida Navigation Co. v. L. Richardson & Co., 282 *Federal Reporter* 241, gave the charterers the option to cancel the charter on the failure of the vessel to report for cargo on or before a specified date. The court, after tritely observing that a charter party is a commercial contract, whose reciprocal provisions must be complied with, held that unseaworthiness of the vessel at the time the charter was entered into was not ground for cancellation of the charter notwithstanding warranty seaworthiness if the vessel was put in seaworthy condition before such specified date; also, that, as the charter party gave the charterers the option to cancel on failure of the auxiliary schooner to report for cargo on or before a specified date, and as on such date the auxiliary engines were not connected with the oil tanks, nor assembled, the charterers could cancel the charter under such provision warranting seaworthiness.

* * *

A tug is obligated to control her tow, it was decided in the case of CHAPMAN BROTHERS, 282 *Federal Reporter* 247, and prevent its swinging with the wind and tide, so as not to embarrass other vessels in properly navigating in the vicinity, and in endeavoring a maneuver in close proximity to the ends of a pier, a vessel should arrange by signal for a clear understanding with other vessels, and failure to do so is a fault for which liability will be imposed.

* * *

"While he is not held to the measure of skill required of the stevedore, whose business it is to safely stow the cargo for transportation upon the lighter, nevertheless, the bargeman is required to exercise ordinary care for the safety of the cargo to load it upon the lighter to the extent of keeping the lighter seaworthy."—EVELYN, 282 *Federal Reporter* 250.

* * *

Unseaworthiness has not the same effect upon the contract of carriage as a voluntary deviation has. The latter displaces the whole contract and leaves the carrier liable as at common law. Unseaworthiness, on the other hand, while it deprives the carriers of the benefit of all exceptions as to liability, leaves the other conditions of the bill of lading in force. Where on a voyage it becomes necessary for the safety of the ship, crew and cargo to seek a port for repairs, such deviation does not displace the contract of carriage, though made necessary by unseaworthiness.—TURRET CROWN, 282 *Federal Reporter* 354.

* * *

Where there is no covenant in a charter party for return of the vessel in good order and condition, such covenant cannot be implied, and the charterer is liable for loss or injury only on proof of negligence.—MONONGAHELA, 282 *Federal Reporter* 17.

* * *

"The question whether the contract is maritime or not depends in this country simply on the subject-matter of the contract, and not on the place where the contract was made. * * * If a contract relates to a ship or to commerce on navigable waters, it is subject to the maritime law, and is within the admiralty and maritime jurisdiction, whether the contract is to be performed on land or water. * * * the service of a stevedore in loading and stowing a ship's cargo is a maritime service, one absolutely necessary to enable the ship to discharge its maritime duty, and it has become a specialized service, devolving upon a class 'as clearly identified with maritime affairs as are the mariners.' * * * it is clearly established the wharves and bridges, being fixed and immovable, are a part of the land to which they are attached, whether they project over the water or not. Injuries done upon them are not maritime torts; consequently they are not within the admiralty jurisdiction, because not done upon the sea. * * * The admiralty has jurisdiction of a suit to recover damages for a maritime tort that occurs on navigable waters, which afford a highway over which commerce may be carried on with other states or foreign countries. If the tort is maritime, the admiralty has jurisdiction, within reference to the nationality of the vessel on board of which it may have been committed, or that of the parties to it. And the test by which it is determined whether the tort is a maritime one depends upon the locality of the person or thing injured at the time the injury is inflicted. * * The term 'tort,' when used in reference to the admiralty jurisdiction, has been held not to be confined to wrongs or injuries committed by direct force, but to include those suffered in consequence of the negligence or malfeasance of others, when the remedy at common law is by action on the case."—Netherlands American Steam Navigation Co. v. Gallagher, 282 *Federal Reporter* 171.

* * *

Where, by the terms of the charter party, the owner warranted that the vessel shall be tight, staunch, strong, and in every way fit for the service, and that it "shall at all times maintain her in a thoroughly efficient state in hull and machinery for the service," and a defect in the engine of the vessel developed only six days after the vessel commenced her voyage, and during that time she had encountered no bad weather, and no peril of the sea or unavoidable accident is shown, it will be presumed that the defect existed when the voyage was commenced, and the charterer is entitled to a deduction for the delay.—American Asiatic Co. v. Robert Dollar Co., 282 *Federal Reporter* 743.

* * *

For an injury to a boat in a collision, it was decided in the case of MASCOT, 282 *Federal Reporter* 766, all the damages suffered should be paid by the party at fault, if the value of the offending boat and the pending freight for the voyage are sufficient to do so. The wrongful act and the measure of the indemnity are not limited by contract, but are coextensive with the damages, including damages for detention of the vessel during the time necessary to make repairs and fit the vessel to resume her work. "Restitutio in integrum" is the leading maxim in such cases.

* * *

Where a shipping contract fixed no time for delivery at all, only the date of sailing, and that somewhat indefinitely, there was no express obligation upon the shipper to deliver at any given time.—J. Aron & Co., Inc., v. Luckenbach Steamship Co., Inc., 282 *Federal Reporter* 937.

* * *

A consignee is liable for demurrage, according to the decision in the case of CORVUS, 282 *Federal Reporter* 939, and its right to collect dispatch money is reciprocal, and may be enforced in a proceeding in rem.

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Converts Tanker to Diesel Electric Drive

The Atlantic Refining Co., Philadelphia, has placed an order with the General Electric Co. covering electric propelling equipment for converting one of its 8000-barrel tankers to diesel-electric drive. This is the fourth equipment ordered by the Atlantic company for this type of propulsion. The new tanker will be a bulk gasoline carrier for coastwise service.

Two 225-horsepower Ingersoll-Rand diesel engines will be used, each driving one 155-kilowatt main generator and a 26-kilowatt auxiliary generator. The two generators will be connected in series and will drive a single 370 brake horsepower propelling motor, the vessel being of the single-screw type.

Control will be of the Ward-Leonard or voltage type, being arranged for operation from the pilot house only. When the craft is in port, one of the main engine generators will be used for furnishing power for driving the cargo pumps while loading and unloading the tanker.

Hamburg-American Fleet Equals Prewar Size

During the past year 18 new ships were built for the Hamburg-American line, increasing the net tonnage of the fleet of this company by 283,700. The Hamburg-American line fleet now totals 400,000 net tons, which is practically the same as it was before the war. More ships are included because the big liners which the company owned prior to the war have not been replaced. No further construction is contemplated at the present time according to an announcement by the board of directors.

Ocean Freight Rates

Per 100 Pounds Unless Otherwise Stated

Quotations Corrected to Feb. 6, 1924, on Future Loadings

NOTE: FREIGHT RATES HAVE HELD STEADY OR ADVANCED.

New York to	Grain	Provisions	Cotton (H. D.)	Flour	General cargo cu. ft.	General cargo 100 lbs.	††Finished steel	REMARKS Freight Offered
Liverpool	4s 0d	$0.50	$0.25	$0.22	$0.40	$0.75	$7.00T	Good
London	3s 6d	0.50	0.25	0.22	0.40	0.75	7.00T	Good
Christiania	$0.20	0.40	0.40	0.27	0.37½	0.80	8.00T	Very Good
Copenhagen	0.20	0.40	0.40	0.26	0.42½	0.85	8.00T	Very Good
Hamburg	0.16	0.35	0.32½	0.22	0.37½	0.75	8.00T	Good
Bremen	0.15	0.35	0.27½	0.21	0.37½	0.75	8.00T	Very Good
Rotterdam	0.16	0.32½	0.25	0.21	0.35	0.70	7.50T	Very Good
Antwerp	0.15	0.32½	0.32½	0.22	0.35	0.70	7.00T	Good
Havre	0.14	0.50	0.22½	0.27½	0.40	0.75	8.00T	Fair
Bordeaux	0.14	0.50	0.22½	0.27½	0.40	0.75	8.00T	Fair
Barcelona	0.20 to 0.25	12.00T	0.40	10.00T	—12.00T—		10.00T	Fair
Lisbon	0.20	0.65	0.40	7.00T	—20.00T—		7.00T	Fair
Marseilles	0.17	0.55	0.50	5.60T	—20.00T—		5.00T	Very Slow
Genoa	0.17½	0.50	0.35	0.30	0.40	0.80	6.00T	Fair
Naples	0.17½	0.50	0.35	0.30	0.40	0.80	6.00T	Fair
Constantinople	0.23	15.00T	0.75	0.35	—20.00T—		8.00T	Good
Alexandria	0.25	15.00T	0.75	0.32½	—20.00T—		8.00T	Not Good
Algiers	0.20	0.75	0.75	0.30	—20.00T—		7.00T	Very Slow
Dakar	.....	14.50T	.....	12.00T	—20.00T—		10.00T	Good
Capetown	6.00T	10.00T	.....	7.50T	—10.00T—		8.00T	Fair to Good
Buenos Aires	.....	18.00 to 20.00T	.....	.....	18.00 to 20.00T†	7.00 to 7.70T		Dropped Off
Rio de Janeiro	.....	19.00 to 21.00T	.....	7.00 to 7.70T	19.00 to 21.00T†	6.00 to 6.60T†		Dropped Off
Pernambuco	.....	22.00T	.....	9.00T	—22.00T—†		8.60T†	Dropped Off
Havana	0.17½ to 0.22½*	0.37½*	.....	0.17½*	0.47*	0.94*	0.20*	Good
Vera Cruz	0.31	0.38	0.44	0.31	0.65½	1.31	0.37½	Good
Valparaiso	.....	1.07	.....	0.70	0.45	0.80	10.00T	Fair
San Francisco	.....	0.40 to 0.70	.....	0.70 to 1.00	.....	2.50	0.55 to 1.00	Very Good
Sydney	.....	18.00T	2.50	18.00T	18.00-24.00T		9.00-12.00T	Very Good
Calcutta	.....	16.00T	0.60	15.00T	—16.00T—		10.00T	Good

T—Ton. †Landed. ††Heavy products limited in length. *Extra charge for wharfage.

NOTE: SPECIAL SURCHARGE OF 25% ON ALL FREIGHT TO MEXICO ON ACCOUNT REVOLUTION

From North Pacific Ports to	Lumber Per m. ft.
San Francisco	$6.00 to 6.50
South California	6.25 to 6.75
Hawaiian Islands	10.00 to 10.50
New Zealand	15.00 to 16.00
Sydney	14.00 to 16.00
Melbourne-Adelaide	15.00 to 17.00
Oriental Ports	12.00 to 15.00
Oriental Ports (logs)	18.00 to 20.00
Peru-Chile	13.00 to 15.00
South Africa	19.00 to 20.00
Cuba	11.00 to 14.00
United Kingdom	80s to 90s
United Kingdom (ties)	70s to 80s
Baltimore-Boston range	$13.00 to 15.00
Baltimore-Boston range. (ties)	Not quoted
Buenos Aires	14.00
Flour and Wheat	
Oriental Ports (net ton)	$ 6.00 to 6.75
U. K. and Continent (gross ton)	37s 6d to 40s
Mediterranean	41s 3d to 42s 6d
General Merchandise	
Oriental ports	$12.00
Steel	
Oriental Ports	$6.50T to 8.00T
Sulphate of Ammonia	
Oriental Ports	$9.00
Cigarets	
Oriental Ports	$12.00
Agricultural Implements	
Oriental Ports	$10.00
Machinery	
Oriental Ports	$10.00
Automobiles	
Oriental ports	$10.00

Principal Rates To and From United Kingdom

	s	d
Grain, River Plate to United Kingdom	27	6
Coal, South Wales to Near East	9	9
Coal, United Kingdom to Hamburg	5	1
Manganese Ore, Poti to Philadelphia	$3.80	
Pig iron, or ferromanganese, United Kingdom to New York or Philadelphia	13	6
Iron ore, Bilbao to Middlesbrough	7	6
Iron ore, North Africa to Philadelphia	7	0

Bunker Prices

At New York

	Coal alongside per ton	Fuel oil alongside per barrel	Diesel oil alongside per gallon
Jan. 11, 1923	$7.90	$1.50	4.75 cents
April 11	6.75@7.50	1.76½	5.10@5.35c
July 11	5.50@7.00	1.76½	4.40@5.50c
Oct. 11	5.25@6.85	1.51¼	4.00@4.50c
Jan. 9, 1924	5.25@6.50	1.41½	4.63@5.42
Feb. 6	5.25@6.50	1.66½	5.15@5.25

At Philadelphia

	Coal alongside per ton	Fuel oil alongside per barrel	Diesel oil alongside per gallon
Jan. 9, 1923	$7.30@8.00	$1.57½	5.00 cents
April 10	6.00@6.50	1.875	5.10 cents
July 9	5.25@6.25	1.62 @1.73	4.35@4.60c
Oct. 11	5.00@5.50	1.36¼@1.51	4.12@4.36c
Jan. 9, 1924	4.90@5.70	1.415	3.86c
Feb. 6	4.65@6.25	1.75	5.41@5.65c

Other Ports

Boston coal, per ton . $7.11
Boston, oil, f. a. s., per barrel $1.33
Hampton Roads, coal, per ton t.i.b. 4.90@5.50
Cardiff, coal, per ton 22s 6d
London, coal per ton 30s
Antwerp, coal, per ton 27s

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Develop Big American Diesel Engine

(*Continued from Page* 101)

port through A-frames and bedplates. This construction is shown in Fig. 1. When the engine is erected, these long bolts are tightened so as to produce an initial tension about 25 per cent greater than the maximum tension arising from the combustion pressure in cylinder. The bolts are of such a size that this initial tension is not more than 20 per cent of the elastic limit of the material. Since the initial tension in the bolts is more than the maximum tension due to combustion pressure, it follows that the bolts do not stretch in the slightest degree while the engine is working. The A-frames are, therefore, always in compression. Since the cylinders are held to the bedplates only by these large bolts passing through A-frames it follows that the latter can never be subjected to tension under any circumstances. This construction gives the utmost rigidity without undue weight, because the cast iron A-frames need be designed only for compression, since the large bolts absorb all the working stresses, producing tension, leaving the A-frames subject only to compression stresses due to initial tension of bolts, weight of parts supported by frames, and on a ship, to such stresses as are due to the rolling of vessel. These latter are only a small percentage of the combustion stresses.

These large bolts pass through the bedplate quite close to the main bearing, the distance from center to center of bolts being less than half the width of the bedplate. Since the part of the bedplate subject to stresses arising from combustion pressures is only the portion between these bolts, it follows that the span of bedplate subject to such stresses is less than half, the stresses in bedplate being consequently less than one-quarter, and the deflection of bedplate less than one-eighth of those encountered in the ordinary design.

Method of Scavenging

The combustion pressures on the power piston acting on the bedplate naturally set up tension stresses in the lower side of the bedplate between the large bolts. To resist these tension stresses, the bedplate is provided in its lower part with the horizontal bolts shown in Fig. 1. During erection, these bolts are subjected to an initial tension about 25 per cent more than the maximum stress due to combustion pressure, in the same way as described for the large vertical bolts. No deflection of bedplate can occur. Thus no part either of the A-frames or bedplates is subject to tension, such tension stresses being exclusively taken by properly designed forged steel bolts, leaving to the cast iron parts only compression stresses, which cast iron is well adapted to resist.

Perfect combustion in any oil engine requires that the power cylinders be efficiently cleared of exhaust gases. In this engine, the scavenging air enters through a central scavenging valve in the extreme upper end of the cylinder, forming an axial column which entirely fills the power cylinder and drives before it the burnt gases, which escape through liberal exhaust ports located around the entire circumference of the lower end of the power cylinder. When using low grade fuels, a certain amount of residue is sometimes deposited on top of the pistons. With this construction, the point is made that such residue deposited in any stroke is, at the end of this same stroke, blown out into the exhaust passages before it has time to be hardened by heat. With this system, scavenging is obtained, no matter how long the stroke may be for a given cylinder bore. The small bore, long stroke engine is more economical in fuel and lower in repair cost than an engine of the same cylinder displacement and piston speed, but in which the stroke and bore are more nearly alike, thus necessitating higher revolutions per minute. The gain in economy and repair costs by building an engine of a given horsepower of small bore, long stroke and low revolutions has always been evident in steam reciprocating engines, but is still more important in internal combustion engines, due to the higher temperatures and pressures necessarily employed.

Engine Speed

For oil engines employed for marine service, an additional reason for slow revolutions exists because in this way a better screw efficiency can be obtained. This type is thus especially designed for this service. The 2-cycle engine is especially adapted to drive a screw because the efficiency of both engine and screw increase as the revolutions per minute decrease.

Injection air is supplied by a 3-stage air compressor driven from a special crank on one end of the crankshaft. Particular care has been taken in designing this compressor to assure reliability in continuous service under both land and marine conditions. The use of compressed air for fuel injection is favored to give better atomization and combustion economy over a much wider range of fuels, particularly among the heavy and cheap grades. This engine has operated on distillate fuels down to 16 degrees Baume as part of the design in order to obtain refinement of control and economy at all speeds and powers, a system of fuel valve lift control was developed. This permits the lift of all fuel valves to be quickly regulated from zero to full lift at any moment by the operator when maneuvering the engine. The proper air and oil ratio may, therefore, be maintained under all conditions. When maneuvering a marine engine or when starting up a land engine, the injection air may be conserved and used in the proper amount.

A simple device is furnished with the engine for removing pistons from the bottom of the cylinders without disturbing any of the valve gear or piping on top of the engine. The advantage of this construction have been proved by extensive operation under both land and marine conditions. The piston rod ready for examination is shown in Fig. 4.

Ease of Maneuvering

In selecting power units for ships, the ease and flexibility of maneuvering with the main engine should be given careful consideration. The Bethlehem oil engine was designed to meet these requirements, due primarily to the simplicity of the reversing gear, to the fuel valve lift control, and to the fact that fuel can be injected into the cylinders without having to shut off the starting air. This last advantage is held of particular importance because the engine remains turning over with air until combustion takes place in a sufficient number of cylinders. The reversing gear is simple because there is only one camshaft. The same set of cams is used for both ahead and astern operation, the camshaft being turned by an air operated reversing gear for the proper timing of the valves in either direction. Reversal from full ahead to full astern may be accomplished in from 10 to 15 seconds. A lever admits starting air to all power cylinders, all of which receive fuel injection simultaneously. When combustion takes place, the further ingress of starting air is automatically prevented. Another lever controls the amount of fuel injected into the cylinders, and works in a double slot somewhat similar to the selective gear lever on an automobile.

When the operator wishes to reverse he pulls the fuel lever toward him as far as he can. This shuts all fuel off the engine. He then moves the lever to his right as far as possible. This, by means of valves, admits compressed air into an operating cylinder which rotates the camshaft so as to bring the cams into the proper astern position, in which position the gear is automatically locked. When the gear has moved into its extreme position, the lever may be pushed out into the right-

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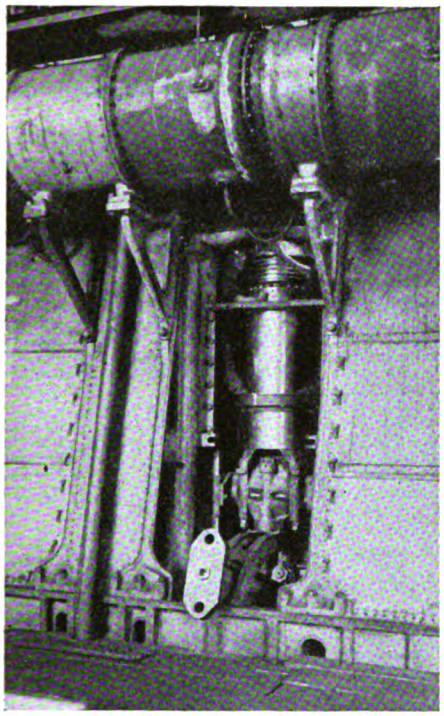

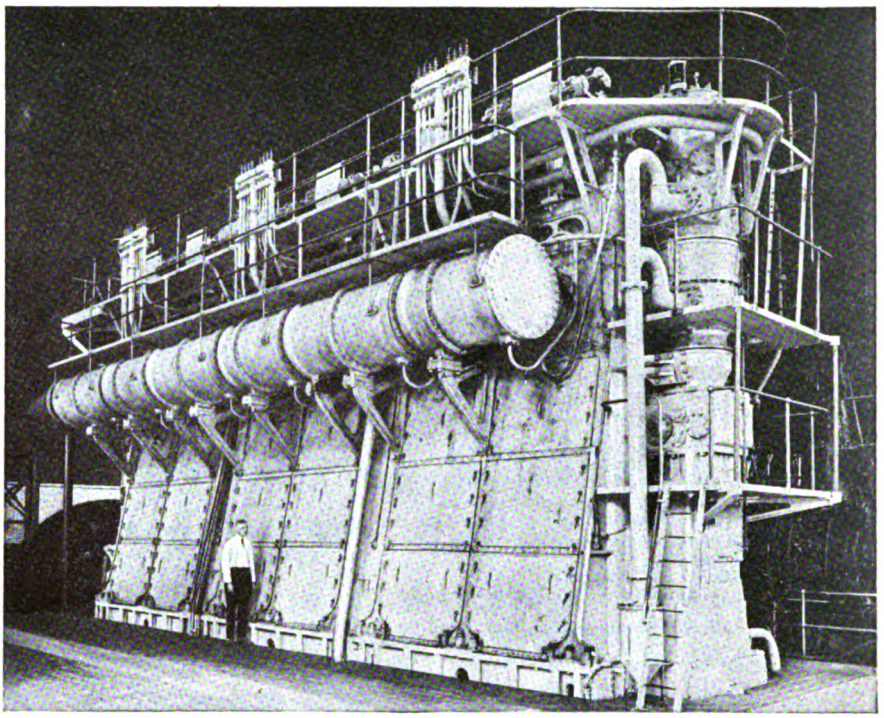

FIG. 4—PISTON READY FOR EXAMINATION, WITH CONNECTING ROD LOWERED. FIG. 5—EXHAUST SIDE OF NEW ENGINE SHOWING AIR COMPRESSION SYSTEM

hand slot, but the operator is prevented from doing this until the air interlocking device is moved out of the path of the lever by the action of the reverse gear completely reaching the end of its travel. The fuel lever is moved out into the astern slot far enough to give the desired power and the engine then goes astern when the operator moves the left hand air lever away from him. This reversing gear was designed to be absolutely fool proof. Another lever determines the lift of the fuel valve so as properly to control the injection air at all speeds and powers, as previously explained.

Scavenging Compressors

The scavenging compressors are arranged on an incline, and are driven from the main connecting rods, as shown in Fig. 1. The scavenging pistons are very light, being made of an aluminum alloy while the scavenging piston rods also are light, being hollow. Due to this fact, the scavenging piston bears lightly on the lower side of the cylinder wall. Since the total forces due to one scavenging compressor are less than 2 per cent of those passing through the main connecting rod by which the compressor is driven, it is evident that no more wear will be found on this main crankpin than on the others. This inclined scavenging compressor drive has been proved by long continued hard service to be a success. It was chosen because it does not increase the length or height of the main engine, and still more important, it does not increase the number of crankshaft bearings which must be kept in line. This detail is especially important on a ship. This arrangement of scavenging compressors also does not take up any floor space.

The general design of the engine is based upon the unit system, each consisting of two power cylinders, cylinder support, A-frames, bedplate section and crankshaft section. This enables the engine to be built as a 2, 4, 6 or 8-cylinder motor by combining these units. The crankshaft sections are interchangeable, each consisting of two cranks set 180 degrees apart together with flanges on each end, forming an integral part of the shaft. The timing of cranks needed for different combination of cylinders is obtained by the manner in which the shaft sections are bolted together. The construction of the section with the cranks opposite was chosen for two reasons.

First, the inertia forces of the reciprocating parts attached to these cranks are, except for the angularity of the connecting rod, equal and opposite. The vertical planes in which these opposing and counterbalancing forces act are closer together than is possible with any other crank arrangement. The comparative closeness of these planes of action keeps down to a minimum the tendency in a ship to produce periodic vibration. The CUBORE, with a 6-cylinder engine, is for this reason said to be remarkably free from such vibration. The second advantage in constructing a shaft section with two opposite cranks is important from a practical point of view. The whole crankshaft section is in one plane, from which it results that on a 6 or 8-cylinder engine a center section of crankshaft can be removed endwise without disturbing either of the other crankshaft sections or any part of the A-frame. Since the injection air compressor is driven from the forward end of the engine and in order to preserve the interchangeability of crankshaft sections, the small crank driving the injection compressor is bolted to the forward flanges of the forward section.

Results of endurance tests of this engine were given in the January issue.

H. E. Diller, 1878-1924

Harry E. Diller, metallurgical editor of *The Foundry*, Cleveland, died Jan. 17, aged 46 years. He was a notable figure in the technical branch of the iron and steel industry, having been active for years in scientific and research work for the General Electric Co., and in the American Foundrymen's association and the American Society for Testing Materials. His research had brought about improvements in electric furnace practice and added to the knowledge of the metallurgy of gray iron, malleable and steel. One of his last scientific works was a discussion he submitted to the annual meeting of the Society of Naval Architects and Marine Engineers in November, 1923, of the paper prepared by Hugo P. Frear of the Bethlehem Shipbuilding Corp. on "The Manufacture of Heavy Steel Castings for Ships with Special Reference to Stern Frames, Rudders, Shaft Brackets and Stems."

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Marine Business Statistics Condensed

Record of Traffic at Principal American Ports for Past Year

New York

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	370	1,513,056	434	1,749,172
December, 1923.	383	1,507,914	445	1,658,425
November	418	1,768,503	461	1,976,338
October	462	1,868,446	489	1,993,758
September	428	1,818,981	477	1,978,023
August	468	1,855,045	520	2,039,732
July	462	1,799,886	490	1,962,302
June	406	1,799,908	518	2,075,654
May	500	1,849,548	501	1,874,019
April	469	1,818,531	467	1,788,555
March	477	1,764,093	494	1,857,212
February	395	1,437,919	413	1,529,096
January	423	1,679,843	439	1,690,010

Philadelphia

(Including Chester, Wilmington and the whole Philadelphia port district)
(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	60	151,915	53	155,550
December, 1923.	78	227,055	64	190,644
November	78	198,122	54	135,077
October	93	241,457	64	178,279
September	92	236,293	74	182,700
August	97	251,295	73	180,771
July	109	269,158	77	177,700
June	102	257,507	69	191,633
May	105	267,441	82	207,209
April	87	218,177	83	229,333
March	111	306,580	76	209,261
February	67	160,678	54	139,701
January	98	287,240	64	182,402

Boston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	84	250,335	47	116,832
December, 1923.	102	285,125	48	130,115
November	91	305,230	60	166,404
October	118	354,296	59	156,940
September	117	307,719	79	185,726
August	126	302,391	86	178,706
July	146	337,033	85	174,106
June	176	319,135	128	176,853
May	159	328,183	108	176,845
April	106	328,372	67	197,510
March	106	330,766	51	139,776
February	102	323,880	48	128,949
January	148	429,849	61	160,090

Portland, Me.

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	22	56,749	23	59,235
December, 1923.	29	104,724	26	100,583
November	25	80,910	24	74,849
October	19	39,456	15	32,471
September	9	22,724	10	25,582
August	11	24,155	8	18,838
July	8	18,148	9	17,770
June	7	22,613	8	25,941
May	8	16,470	11	17,781
April	22	75,012	29	100,274
March	29	94,128	31	83,391
February	33	91,190	36	100,312
January	49	144,429	42	126,949

Providence

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	8	33,215	7	28,927
December, 1923.	12	43,345	7	23,294
November	5	23,038	6	15,700
October	8	30,248	9	24,821
September	9	31,514	12	41,646
August	9	34,323	9	27,664
July	10	25,155	7	29,316
June	7	25,466	5	17,238
May	9	31,731	8	38,870
April	10	33,783	12	41,352
March	8	31,910	8	34,367
February	17	56,353	10	39,840
January	13	45,175	12	52,651

Baltimore

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	85	270,169	99	315,804
December, 1923.	117	365,142	110	354,229
November	90	280,617	91	279,278
October	96	285,871	95	297,566
September	94	292,315	99	297,965
August	100	303,073	92	262,306
July	130	390,465	137	395,206
June	140	407,872	135	406,138
May	156	476,041	160	468,248
April	159	470,698	138	416,969
March	123	375,762	117	354,803
February	80	240,133	94	275,291
January	115	322,661	110	306,393

Norfolk and Newport News

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	31	96,074	79	249,575
December, 1923.	30	86,444	75	219,325
November	24	65,263	83	239,807
October	18	56,473	65	188,805
September	14	37,823	65	184,646
August	36	113,070	81	244,366
July	41	108,465	108	296,197
June	36	107,218	66	190,218
May	62	188,850	93	286,420
April	21	65,350	73	212,453
March	16	51,333	71	200,858
February	8	24,958	42	130,121
January	14	41,127	44	121,152

Savannah

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
December, 1923.	26	72,541	21	64,973
November	24	75,739	23	67,551
October	31	89,817	33	91,089
September	29	82,569	27	83,689
August	18	55,205	20	59,452
July	18	53,071	22	60,711
June	27	77,392	31	90,636
May	26	67,494	23	63,395
April	26	81,582	27	83,365
March	31	95,905	30	89,323
February	31	87,315	31	87,703
January	28	93,564	28	93,587
December, 1922.	22	66,619	17	57,279

Key West

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	69	79,224	70	82,775
December, 1923.	71	88,377	71	91,121
November	80	97,642	85	97,599
October	83	103,328	82	95,506
September	69	77,687	74	84,612
August	80	94,591	82	93,028
July	88	96,514	86	97,260
June	93	105,045	93	102,123
May	97	102,033	95	101,422
April	84	85,964	83	88,475
March	91	88,639	90	83,220
February	69	68,735	64	68,658
January	89	81,622	86	79,210

Portland, Oreg.

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
December, 1923.	30	99,748	34	120,487
November	30	113,362	34	120,487
October	21	78,191	48	174,275
September	23	86,194	41	138,470
August	17	64,218	31	106,478
July	19	66,048	24	86,474
June	22	87,147	25	87,419
May	16	58,889	21	72,663
April	17	62,287	22	84,940
March	16	69,514	22	78,124
February	13	46,219	18	66,446
January	12	47,848	25	97,674
December, 1922.	13	46,245	31	104,065

New Orleans

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924..	217	595,087	220	588,703
December, 1923.	239	632,193	231	634,300
November	216	575,102	218	605,923
October	226	605,211	239	649,791
September	205	548,914	169	444,881
August	235	605,671	249	639,802
July	237	602,017	227	587,966
June	230	584,271	226	572,211
May	221	550,817	237	603,128
April	234	612,572	237	623,539
March	253	648,990	269	682,080
February	204	559,638	206	539,965
January	242	713,589	233	695,524

Galveston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	70	210,110	96	317,105
December, 1923.	71	219,767	106	313,231
November	61	172,824	95	301,148
October	83	209,343	108	334,544
September	64	164,854	100	290,715
August	69	172,330	92	257,371
July	70	178,601	77	198,200
June	77	178,013	82	209,893
May	78	181,759	97	256,745
April	65	162,317	77	209,388
March	58	170,841	97	287,278
February	48	146,944	76	233,591
January	69	219,967	89	282,889

Port Arthur, Tex.

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
September, 1923.	31	88,978	42	121,898
August	45	122,018	56	156,908
July	36	107,997	49	122,785
June	52	161,207	57	174,651
May	59	187,057	64	206,089
April	58	191,158	56	188,376
March	64	188,176	55	169,005
February	52	172,273	44	142,554
December, 1922.	59	210,778	65	218,274
November	42	143,551	47	154,010
October	68	227,039	66	217,502
September	53	158,181	57	168,681

Mobile

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	81	158,416	83	159,081
December, 1923.	83	165,163	75	156,579
November	74	148,297	78	145,886
October	68	123,532	60	120,606
September	60	126,005	52	105,247
August	64	191,968	67	146,191
July	73	136,242	66	123,405
June	64	136,311	61	132,863
May	74	167,509	74	174,851
April	85	199,871	82	163,074
March	88	203,032	88	206,285
February	83	186,479	72	160,777
January	77	145,151	67	153,001

Houston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	60	55,037	58	267,066
December, 1923.	74	73,876	70	304,359
November	84	83,490	82	350,703
October	75	24,076	70	268,416
September	66	58,704	61	92,664
August	58	43,258	56	211,348
July	48	42,447	48	177,666
June	49	72,875	50	197,081
May	54	60,640	50	182,691
April	47	72,722	55	119,521
March	54	69,428	51	135,906
February	49	50,379	48	167,872
January	49	36,744	52	146,532

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Marine Business Statistics Condensed

Port Traffic Record

San Francisco

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	65	215,020	68	229,206
December, 1923.	63	209,105	68	234,960
November	69	281,081	70	243,152
October	56	205,175	71	249,035
September	43	165,798	63	209,930
August	64	208,625	65	224,918
July	68	244,530	58	189,348
June	59	204,204	65	227,566
May	64	230,778	69	244,321
April	61	199,831	63	227,467
March	50	168,399	71	237,195
February	47	165,333	60	214,686
January	51	156,249	65	216,083

Los Angeles

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
December, 1923.	165	285,919	103	261,322
November	243	234,357	188	220,733
October	178	236,116	242	194,872
September	88	257,074	110	193,177
August	80	193,400	63	161,380
July	78	265,294	56	187,987
June	87	212,483	53	175,799
May	78	246,275	53	179,360
April	87	269,264	72	165,302
March	115	251,459	90	185,155
February	86	148,957	83	137,564
January	91	153,564	92	141,332
December, 1922.	133	132,114	76	83,537

Seattle

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
January, 1924...	57	233,002	60	242,577
December, 1923.	48	206,466	52	224,112
November	48	199,115	46	191,022
October	39	184,717	47	200,668
September	32	142,052	40	159,006
August	39	173,885	37	163,188
July	30	148,607	32	149,239
June	36	147,186	39	184,732
May	29	133,752	37	159,393
April	32	141,569	31	133,950
March	28	129,070	30	138,428
February	26	120,548	39	156,258
January	27	125,551	36	155,129

Gothenburg, Sweden's principal seaport, has become one of the important passenger transit centers of Europe. The Swedish American line handled 30,000 passengers at the port in ten months of 1923. That line is constructing a monumental building which occupies an entire block and bears the inscription 'Amerikahuset' or America House. Offices and some living quarters will fill up the building, while an annex will house services of the line, such as the laundry.

Charles D. Bowles, prominent in north Pacific shipbuilding circles, died in Portland, Oreg., recently. He was president of the Bowles Plumbing Co. and was one of the founders of J. F. Duthie & Co., Seattle shipbuilders who operated actively during the war period. He was also vice president of the Columbia River Shipbuilding Co. and the Northwest Steel Co., also of Portland. Mr. Bowles left an estate appraised at $1,500,000.

Record of Traffic Through Panama Canal

		Atlantic to Pacific traffic —Panama Canal— No. of ships	Net tonnage	Tons of cargo	Pacific to Atlantic traffic —Panama Canal— No. of ships	Net tonnage	Tons of cargo	Total traffic through canal —Panama Canal— No. of ships	Net tonnage	Tons of cargo
1923										
December	American	143	760,701	316,251	127	708,126	1,115,399	270	1,468,827	1,431,650
	Foreign	135	607,041	418,027	101	440,623	644,957	236	1,047,664	1,062,984
	Totals	278	1,367,742	734,278	228	1,148,749	1,760,356	506	2,516,491	2,494,634
November	American	116	627,115	323,129	128	680,833	1,108,292	244	1,307,948	1,431,421
	Foreign	115	537,180	309,785	77	348,737	477,089	192	885,917	786,874
	Totals	231	1,164,295	632,914	205	1,029,570	1,585,381	436	2,193,865	2,218,295
October	American	132	727,005	286,947	129	687,521	1,141,192	261	1,414,526	1,428,139
	Foreign	97	451,734	335,800	69	273,215	363,628	166	724,949	699,428
	Totals	229	1,178,739	622,747	198	960,736	1,504,820	427	2,139,475	2,127,567
September	American	111	598,331	251,797	126	686,359	1,132,572	237	1,284,690	1,384,369
	Foreign	87	382,506	259,922	89	377,356	524,412	176	759,862	784,334
	Totals	198	980,837	511,719	215	1,063,715	1,656,984	413	2,044,552	2,168,703
August	American	157	825,056	435,851	127	670,023	1,071,457	284	1,495,079	1,507,308
	Foreign	104	445,708	302,749	66	291,803	358,693	170	737,511	661,442
	Totals	261	1,270,764	738,600	193	961,826	1,430,150	454	2,232,590	2,168,750
July	American	146	743,072	361,335	139	751,940	1,194,357	285	1,495,012	1,555,692
	Foreign	109	464,386	328,697	80	350,629	453,395	189	815,015	782,092
	Totals	255	1,207,458	690,032	219	1,102,569	1,647,752	474	2,310,027	2,337,784
June	American	131	705,481	385,843	115	607,950	1,022,421	246	1,313,431	1,408,264
	Foreign	96	405,816	270,146	75	316,655	418,036	171	722,471	688,182
	Totals	227	1,111,297	655,989	190	924,605	1,440,457	427	2,035,902	2,096,446
May	American	133	715,061	406,699	120	651,504	1,096,175	253	1,366,565	1,502,874
	Foreign	96	424,600	335,652	70	337,249	426,557	166	761,849	762,209
	Totals	229	1,139,661	742,351	190	988,753	1,522,732	419	2,128,414	2,265,083
April	American	123	662,300	331,114	116	637,178	1,041,481	239	1,299,478	1,372,595
	Foreign	81	360,318	322,255	84	347,894	492,295	165	708,212	814,550
	Totals	204	1,022,618	653,369	200	985,072	1,533,776	404	2,007,690	2,187,145
March	American	119	635,992	348,598	96	509,443	819,204	215	1,145,435	1,167,802
	Foreign	114	505,290	329,890	80	337,467	443,236	194	842,757	773,126
	Totals	233	1,141,282	678,488	176	846,910	1,262,440	409	1,988,192	1,940,928
February	American	97	486,186	325,835	82	422,871	633,458	179	908,673	959,293
	Foreign	78	354,190	237,604	69	266,300	366,381	147	620,874	603,985
	Total	175	840,376	563,439	151	689,171	999,839	326	1,529,547	1,563,276
January	American	88	450,254	313,094	67	320,300	462,245	155	770,554	775,339
	Foreign	106	473,524	285,649	91	366,614	530,944	197	840,138	816,593
	Total	194	923,778	598,743	158	686,914	993,189	352	1,610,692	1,591,932
1922										
December-	American	78	363,857	328,924	68	344,847	551,907	146	710,704	880,831
	Foreign	83	352,020	231,494	75	312,539	422,777	158	664,559	654,271
	Total	161	717,877	560,418	143	657,386	974,684	304	1,375,263	1,535,102
November	American	65	324,783	234,500	55	273,293	416,515	120	598,076	651,015
	Foreign	83	370,180	266,878	91	369,024	508,967	174	739,204	775,845
	Total	148	694,963	501,378	146	642,317	925,482	294	1,337,280	1,426,860
				Vessels in Ballast						
1923										
December	American	75	438,590	0	0	0	0	75	438,590	0
	Foreign	48	192,416	0	3	9,580	0	51	201,996	0
	Totals	123	631,006	0	3	9,580	0	126	640,586	0
November	American	52	307,299	0	2	8,323	0	54	315,622	0
	Foreign	39	162,303	0	2	9,554	0	41	171,857	0
	Totals	91	469,602	0	4	17,877	0	95	487,479	0
October	American	73	443,618	0	2	3,165	0	75	446,783	0
	Foreign	17	77,706	0	2	4,903	0	19	82,609	0
	Totals	90	521,324	0	4	8,068	0	94	529,392	0
September	American	59	352,792	0	1	5,233	0	60	358,025	0
	Foreign	19	85,041	0	3	12,121	0	22	97,162	0
	Totals	78	437,833	0	4	17,354	0	82	455,187	0
August	American	82	477,284	0	2	6,073	0	84	483,357	0
	Foreign	24	100,910	0	3	9,581	0	27	110,491	0
	Totals	106	578,194	0	5	15,654	0	111	593,848	0
July	American	76	443,654	0	4	12,848	0	80	456,502	0
	Foreign	25	107,103	0	3	9,580	0	25	116,683	0
	Totals	101	550,757	0	7	22,428	0	105	573,185	0
June	American	70	422,173	0	0	0	0	70	422,173	0
	Foreign	27	118,540	0	2	7,255	0	29	125,795	0
	Totals	97	540,713	0	2	7,255	0	99	547,968	0
May	American	72	422,947	0	3	10,658	0	75	433,605	0
	Foreign	23	87,784	0	2	4,750	0	25	92,534	0
	Totals	95	510,731	0	5	15,408	0	100	526,139	0
April	American	67	393,895	0	3	18,837	0	70	412,735	0
	Foreign	11	44,214	0	2	9,412	0	13	53,626	0
	Totals	78	438,109	0	5	28,249	0	83	466,358	0
March	American	60	359,006	0	4	7,841	0	64	366,847	0
	Foreign	35	144,223	0	3	9,915	0	38	154,138	0
	Totals	95	503,229	0	7	17,756	0	102	520,985	0
February	American	36	229,578	0	0	0	0	36	229,578	0
	Foreign	24	105,848	0	3	7,486	0	27	113,334	0
	Total	60	335,426	0	3	7,486	0	63	342,912	0
January	American	29	181,617	0	2	10,141	0	31	191,758	0
	Foreign	26	109,586	0	1	4,942	0	27	114,528	0
	Total	55	291,203	0	3	15,083	0	58	306,286	0

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Late Flashes On Marine Disasters

Brief Summaries of Recent Maritime Casualties— A Record of Collisions, Wrecks, Fires and Losses

Name	Date	Nature	Place	Damage Resulting
Alberta	Jan. 5	Disabled	Boston	Steerer dam.
Acacia	Jan. 8	In distress	Key West	In tow
Anchor Light	Jan. 10	Fire	New York	Slight
Aladdin	Jan. 5	Gales	off Cape Hatteras	Lifeboat smashed
Arkansas	Jan. 11	Struck sub. obj.	nr. River Tyne	Bot. dam.
Arundale	Jan. 9	Hvy. weather	nr. Queenstown	Rudder loose
Aryan	Jan. 11	Hurricane	at sea	Extens. deck damage
Amazon	Dec. 18	Collision	Cuba	Undam.
Angeles	Jan. 11	Fire	Staten Island	To crew's quarters
Albert S. Boulton	Dec. 29	Ashore	Port Aux Basques	Sunk
Ansado VII	Jan. 13	Grounded	Cape Fear Bar	Floated
Annie M. Parker	Jan. 15	Abandoned	at sea	Not stated
Alabama	Jan. 25	In ice	Grand Haven	Not stated
Airedale	Jan. 11	Gale, drifted	St. Johns	Collision
Annie M. Records	Jan. 17	Stranded	Cape Lookout	Not stated
Agwimoon	Jan. 8	Collision	Tampico	Not stated
Anna Louise	Jan. 20	Gale	Portland, Me.	Mast gone, jib torn
Agwiworld	Jan. 23	Collision	Fall River	Slight
Augusta	Jan. 23	Disabled	New York	Leak. badly
Annie C. Ross	Jan. 19	Grounded	Town River	Undam.
Active	Jan. 28	Hit wharf	Philadelphia	Sunk
Anaconda	Jan. 28	Collision	River Scheldt	To plates under water
Archer	Jan. 31	Disabled	St. Michaels	Prop. trouble
Antilla	Jan. 30	Disabled	New Orleans	Eng. trouble
Barge 787	Jan. 14	Collision	East River, N.Y.	Sunk
Bankdale	Jan.	Fire	at sea	Not stated
Big Ben	Jan. 20	Explosion	Brooklyn	Sunk
Balsam	Jan. 20	Struck quay	Dublin	Damaged
Brecon	Jan. 20	Struck quay	London	Leak. in eng. space
Beemsterdijk	Jan. 22	Disabled	500 m. off Boston	Rudder and stern frame gone
Bacoi	Jan. 23	Collision	Fall River	Not stated
Bodwell	Jan. 26	Grounded	nr. Swans Island	Deckhouse gone
Burgerdijk	Feb. 1	Fire	at sea	To main deck
Bremerton	Jan. 22	Hvy. weather	at sea	To deck fit. & sm. boat
Cape Race	Dec. 27	Drifted, col.	St. Johns	Not stated
Colin H. Livingstone	Jan. 7	Grounded	nr. Gorgona, P.C.	Proceeded
Canadian Seigneur	Jan. 9	Disabled	Honolulu	Eng. dis.
Cross Keys	Dec. 28	Collision	Tacoma	Not stated
Cornelius H. Callaghan	Jan. 14	Ashore	W. of St. Andrews	Broken amidship
Chinese Prince	Jan. 15	Disabled	Fayal	Cond. pipe split
Cairntorr	Jan. 15	Struck sub. obj.	North Sea	Tank leak.
Commercial Spirit	Jan.	Grounded	Columbia River	Undam.
Cheboygan	Jan. 25	In ice	Muskegon	Not stated
Cederic	Jan. 22	Collision	East River, N.Y.	Undam.
Capena	Jan. 14	Collision	Port Arthur	Bow twisted
Caspar	Jan. 23	Collision	NW of Point Reles	Bel. waterline
Carlos	Jan. 23	Collision	NW of Point Reles	Not stated
Cecil	Jan. 10	Rough weather	at sea	Jettis cargo
Colombo	Jan. 28	Fire	New York	To eng. rm.
Coronado	Jan. 29	Ashore	Jamaica	Dangerous pos.
C. C. Wehrum	Jan. 22	Beached	80 m. off Progreso	Undam.
Colburra	Jan. 30	Disabled	N of San Francisco	Lost rudder
Donald Silver	Dec. 29	Not stated	St. George Bay	Lost
"D"	Jan. 8	Fire	New York	Not stated
Dictator	Jan. 10	Fire	New Orleans	Slight
Dornbos	Jan. 25	In ice	Grand Haven	Not stated
Dunham Wheeler	Jan. 21	Leaking cons.	Cape Lookout	Not stated
Edna Hoyt	Jan. 6	Collision	SSW of Barnegat buoy	Headgear gone
Esther Dollar	Jan. 9	Grounded	bel. North Point	Jettis. cargo
Eastern Dawn	Jan. 11	Forehold leak.	St. Michaels	Not stated
Ellen Little	Jan. 10	Leaking	Bermuda	Not stated
Eskbridge	Jan. 13	Hvy. weather	St. Johns	To bulwarks bridge, rudder & steerer
El Valle	Jan. 16	Collision	New York	Not stated
Egremont Castle	Jan. 16	Disabled	Honolulu	Engs. dis.
E. C. Adams	Jan. 2	Ashore in Nov.	off Halifax	Damaged
Eastern Planet	Jan. 16	Disabled	New York	Eng. trouble
Edgehill	Jan. 18	Gales	St. Michaels	Damaged
El Paso	Jan. 18	Gales	St. Michaels	Damaged

Name	Date	Nature	Place	Damage Resulting
Ethelwolf	Jan. 17	Disabled	Fayal	Steerer dam.
Elmspark	Jan. 19	Lost prop. blades	New York	Shaft broke, water in tunnel
Emmett McLaughlin	Jan. 27	Capsized	off Greenville	Not stated
El Monte	Jan. 27	Ashore	off Havre	Leaking
Elvenes	Jan. 28	Disabled	Stornoway	Rudder post damaged
El Estero	Jan. 31	Collision	Governor's Island	Steerer trouble
Edith	Feb. 2	Disabled	nr. Reedy Island	Not stated
Feronia	Jan. 8	Sinking condition	off Ushant L.S.	Sunk
Falkirk	Jan. 16	Dismasted	at sea	in tow
Funchal	Jan.	Struck rocks, ashore	West Island	Damaged
Francis O'Boyle	Jan. 17	Sank	nr. Cape Henry	Not stated
Frank Brainerd	Jan.	Ashore winter 1923	Southwest Harbor	Raised and rep.
Glentworth	Jan. 4	Grounded	Wilmington	Floated
Glymont	Dec. 28	Collision	Tacoma	To lifeboat
General Jacobs	Jan. 10	Fire	Burin, NF	May be total loss
Gloria De Larrinaga	Jan. 12	Hvy. weather	St. Michaels	Sundry losses, steerer dis.
Greater New York	Jan. 13	Not stated	New York	Sunk
Grand Haven	Jan. 25	In ice	off Grand Haven	Not stated
Glyndon	Jan. 16	Broke from mooring	Navassa	Drifted
Governor Bodwell	Jan. 26	Storm, ashore	Swans Island	Filling
G. J. King	Feb. 2	Not stated	off Mispec	Sunk
Hickman	Jan. 5	Hurricane, adrift	at sea	Steerer gone
Hortense	Jan. 11	Ashore	Graves	Leaking
Hollinside	Jan. 12	Hvy. weather	Horta	Sundry losses
Humorist	Jan. 8	Disabled	at sea	Rudder post dis., leaks
Hadnot	Jan. 21	Ashore	off Nyborg	Jettis. cargo
H. L. Neff	Jan. 25	Cut by ice	off North Point	Sunk
Hilton	Jan. 26	Gale, col.	Portland, Me.	To several plates
Ibukisan Maru	Jan. 10	Ashore	Tokio Bay	Making water
International	Jan. 28	In ice	St. Clair River	Broke rudder stock
Innoko	Jan. 26	Collision	off New York	Damaged
J. W. Comeau	Jan. 9	Not stated	at sea	Abandoned
Julia	Jan 10	Fire	New York	Slight
Jim	Jan. 11	Sank	Brooklyn	Raised
Jennie R. Morse	Jan. 22	Fire	at sea	Cons. to ship & cargo
Janelew	Jan. 23	Disabled	Charleston	Boil. trouble
Josiah B. Chase	Jan. 23	Dragged anchor	Portland, Me.	Lost anchor and chain
Jennie Flood Kreger	Jan. 26	Badly iced, in tow	off Portland	Sails and gaffs dam.
Johan Poulsen	Jan. 29	In tow	San Francisco	Prop. lost
Jalapa	Feb. 4	Col., grounded	Suez	Hole in tank
Lydia McLennan Baxter	Jan. 7	Fire	Brooklyn	Slight
Legie	Jan. 12	Disabled	at sea	Not stated
Lecie, C. S.	Jan. 14	Disabled	off Genoa	Not stated
Liberty Bond	Jan. 17	Collision	off Liberty	Sunk
Lio	Jan. 24	Disabled	off Newcastle, Del.	Machy. deranged
The Lambs	Feb. 1	Defective mchy.	Marseilles	Jettis. cargo
Lucerna	Jan. 30	Rough passage	Halifax	Minor troubles
Madelyn E. Adams	Dec. 30	Ashore	Halifax	Leaking
Moby Dick	Jan. 7	Ashore	Miami Beach	Floated
Macoris	Jan. 7	Foundered	off Island of Crete	Not stated
Marinula	Jan. 10	Disabled	off Staten Island	Eng. broke
Margaret G.	Jan. 11	Waterlogged	at sea	In tow
Miller County	Jan. 12	Disabled	Marcus Hook	Sl. eng. trouble
Melmore Head	Jan. 12	Fire	Belfast	To cargo
Mary Hanlon	Jan.	Gale	Sinslaw River	Leak. badly
Marine	Jan. 13	Adrift	nr. Plymouth	Lost prop.
Milwaukee	Jan. 28	Collision	Lake Michigan	Hole in bow
Missouri	Jan. 25	In ice	off Holland	Not stated
Milwaukee	Jan. 25	In ice	Grand Haven	Not stated
Maria A. Howes	Dec. 18	Collision	Cuba	Slight
Mexicana	Jan. 8	Collision	Tampico	Plates dam.
Mary G. Naymard	Jan. 19	Gale	Norfolk	Sails gone

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Late Flashes On Marine Disasters

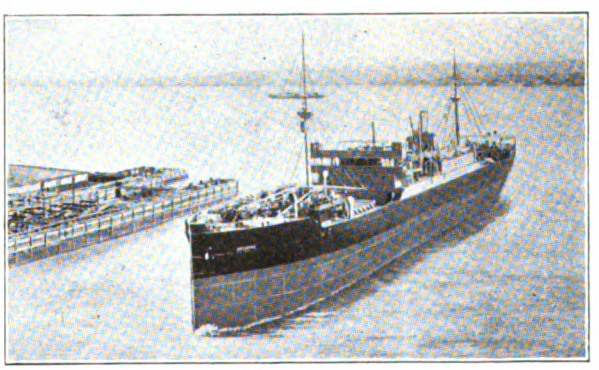
Brief Summaries of Recent Maritime Casualties— A Record of Collisions, Wrecks, Fires and Losses

Name	Date	Nature	Place	Damage Resulting
Montrolite	Jan. 23	Disabled	Charleston	Eng. trouble
Mac C.		Sunk	Folly Passage	Stern out
Mojave	Jan. 24	Disabled	nr. Honolulu	Piston broke
Myriam Blexen	Jan. 28	Disabled	St. Michaels	Rudder dam.
Mary Horlock	Jan. 26	Sinking cond.	at sea	Abandoned
Muenchen	Jan.	Ashore	Bremerhaven	Bot. dam.
Munmotor	Jan. 27	Grounded	Seven Foot Knoll	Floated
Munalbro	Jan. 26	Gale, col.	Portland, Me.	Undam.
Maid of Scotland	Feb. 1	Collision	off Partridge Island	Sunk
Mojave	Jan. 24	Eng. trouble	Honolulu	Jettis. cargo
Norfolk Maru	Jan. 7	Broke moor., grounded	Port Townsend	Uninjured
Normannia	Jan. 17	Leaking	at sea	Sunk
Northern, No. 8	Jan. 18	Ashore	Long Branch	Proceeded
New York	Jan. 17		New London	Undam.
Navigator	Jan. 20	Hvy. weather	at sea	To cargo
Norman	Jan. 31	Collision	off Governor's Island	Sunk
Ostende	Jan. 16	Ashore	off Terneuzen	Proceeded
Osterdal	Jan. 30	Rough sea	St. Michaels	Badly dam.
Perry Setzer	Jan. 8	Ashore	E of Fire Island Inlet	Jettis. cargo
Persier	Jan. 3	Grounded	Cape Fear River	Broke prop. blades
Port Elliott	Jan. 13	Ashore	nr. East Cape	Leak. badly
Princess	Jan. 16	Collision	New York	Sunk, raised
Polarhavet	Jan. 16	Hvy. weather	St. Michaels	Deck fit. damaged
Pere Marquette 17	Jan. 28	Collision	Lake Michigan	Not stated
Patrick Henry	Jan. 31	Disabled	nr. Norfolk	Prop. blade lost, 2 bent
Perena	Feb. 1	Collision	off Partridge Island	Not stated
Rassapeague	Jan. 7	Disabled	Bermuda	Leaking
Royal Arrow	Jan. 8	Fire	Staten Island	Slight
Rosario	Jan. 8	Stranded	American Shoals	Floated
Ruth E. Merrill	Jan. 12	Opened up	nr. Woodshole	Sunk
R. R. No. 19	Jan. 17	Capsized	off New York	Not stated
Rosalind	Jan. 11	Gale, Col.	St. Johns	Railing smashed
R. L. Agassiz	Jan. 27	Disabled	Buffalo	49 plates damaged
Robert J Dale	Jan. 23	Ashore	St. Marys Bay	Pounding heavily
Raimund	Jan. 25	Collision	Galveston	Damage to forecastle
Racine	Jan. 31	Collision	Governor's Island	Sunk

Name	Date	Nature	Place	Damage Resulting
Sorriso	Dec. 8	Disabled	West of Bermuda	Steerer dis.
St. Clair Theriault	Jan. 7	Was ashore	Rockland	Leaking
Santurce	Jan. 9	Grounded	off Cape Lookout	Leaking
Springfield	Jan. 15	Disabled	Southport Harbor	Steerer dis.
Senator Bailey	Jan. 10	Disabled	Galveston	Leak. badly
Silverado	Jan. 17	Fire	San Francisco	No. 1 hold
Smith & Terry No. 4	Jan. 17	Lost chain & anchors	Hampton Roads	Not stated
Sheyboygan	Jan. 27	Ice	Lake Michigan	Rudder broke
Socony No. 94	Jan. 14	Collision	Port Arthur	Not stated
Stuijvesant	Jan. 23	Hvy. weather	Barbados	Boats & cargo dam.
Slavic Prince	Jan. 22	Disabled	Boston	Steerer trouble
Severance	Jan. 26	Collision	off New York	Damaged
Springfield	Jan. 26	Not under control	New York	Not stated
Spitfire	Jan. 14	Hvy. weather	off St. Johns, NF	Badly dam.
Scythian	Jan. 26	On rocks	Halifax	Hole in hull
Suphenco	Jan. 22	Struck light	Mobile Bay	Consider'ble
Sartatia	Feb. 1	Disabled	Sandy Hook	Not stated
Schoharie	Feb. 1	Disabled	Halifax	Boil. trouble
Sundance	Jan. 31	Ashore	off Hansweerd	Floated
Thomas A. Quigley	Jan. 13	Fire	Tebo Yacht Basin	Not stated
Truxillo	Jan. 15	Disabled	off New Orleans	Rudder broke
Trontolite	Jan. 20	Disabled	New York	Not stated
Trelevan	Jan. 28	Disabled	Balboa	Boils. dam.
Thuban	Feb. 3	Grounded	Ship Island	Not stated
Utah	Jan. 12	Fire	Houston	Cotton dam.
Vacuum	Jan. 13	Disabled	New York	Windlass cyl. broke
Virginia	Jan. 13	Struck sub. wreck	North Sea	Cons. dam.
West Tacook	Jan. 2	Grounded	Cape Fear River	Not stated
Warburg	Jan. 11	Fire	New York	Slight
West Cherow	Jan. 12	Rough Sea	St. Johns	Tank & bilge leak.
Watertown	Jan. 22	Disabled	Delaware Breakwater	Boil. trouble
William E. Litchfield	Jan. 22	Disabled	Portland, Me.	Not stated
Wearbridge	Jan. 21	Rough sea	at sea	Boat smash. hatch cover gone
Warren	Jan. 24	Fire	London	Slight to hull
West Hardaway	Jan. 26	Disabled	Queenstown	Prop. lost
West Camak	Jan. 25	Collision	Galveston	Not stated
West Celna	Jan. 28	Disabled	Boston	Leaking
West Campgaw	Feb. 2	Disabled	New York	Not stated

Use Electricity To Heat Water on Motorship

The motorship SEEKONK converted to diesel drive by the William Cramp & Sons Ship & Engine Building Co., Philadelphia, using engines built in its own plant, has a number of interesting units aboard. Included among these is a new type of water heater which though small in relative importance, meets a need. This is an electric type heater designed to provide a dependable supply of hot water to the bath and shower, independent of any other equipment. The heater is manufactured by the Automatic Electric Heater Co., Warren, Pa., which has been manufacturing such units for domestic and industrial purposes for a number of years. The heater as installed on the SEEKONK is fitted with a temperature control to prevent excessive over heating of the water with the consequent wastage of current.



AMERICAN EQUIPPED MOTORSHIP SEEKONK

All the records of the war period were broken by Seattle's waterborne commerce in 1923, the totals showing 6,451,180 tons, a gain of more than a million tons over 1922.

Another Big Lake Ship Will Be Built

Another big Great Lakes freighter will be built this year. The Great Lakes Transportation Co., Midland, Ont., controlled by James Playfair, and operator of a large fleet under Canadian register, will add another grain carrier. This vessel will be 530 feet in length, 60 feet beam and 32 feet deep, having standard lake dimensions for beam and depth but being shorter than the typical freighter with its 600-foot length. The Midland Shipbuilding Co., Midland, Ont., will construct this new vessel.

Vessel activities in Baltimore's foreign trade during January show total entrances of 85 vessels, of 270,169 net tons and clearances of 99 vessels of 315,804 net tons.

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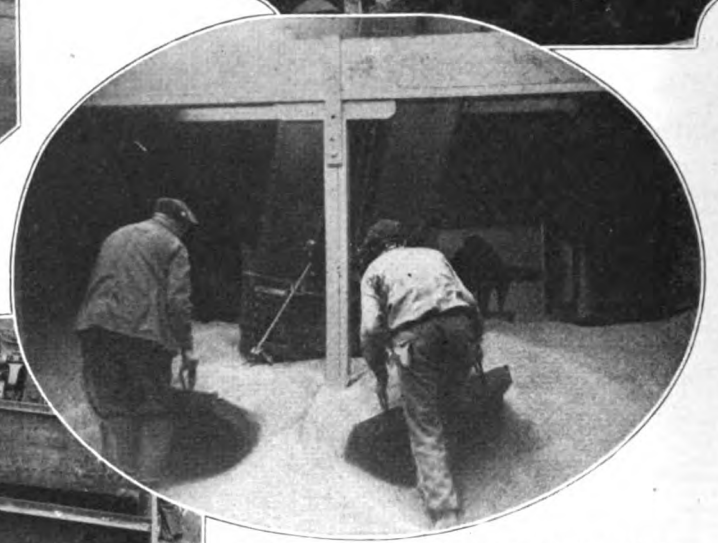
Photographs from Far and Near

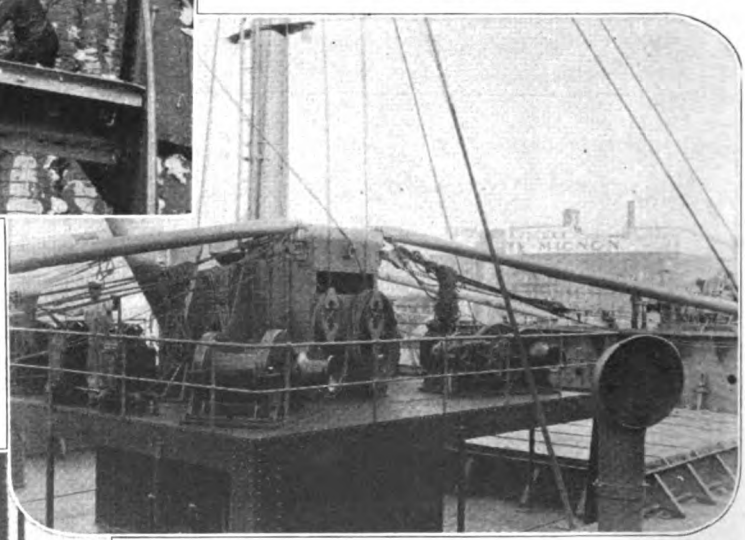
Picturesque harbor of Helsingborg, Sweden, on sound dividing that nation and Denmark.

Famous Hell Gate passage, New York

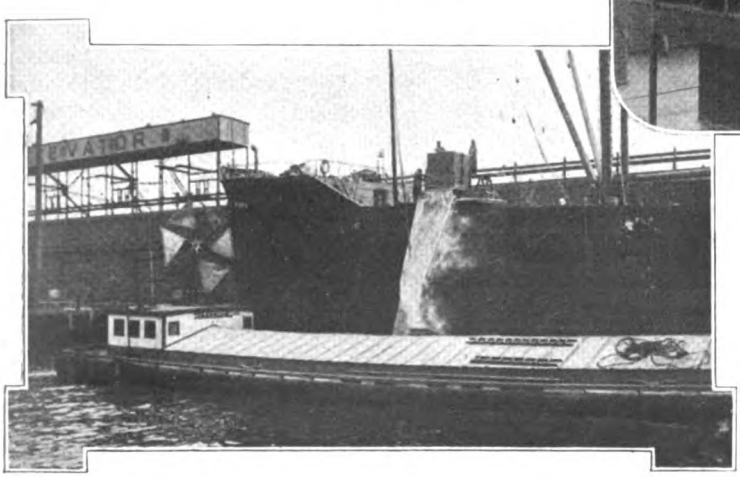


Feeding grain to "marine leg," endless belt with buckets, at barge canal terminal, Brooklyn

Loading high density cotton into ship's hold at New Orleans. Excellent warehouses, piers and belt lines have done much to give New Orleans rank as second U. S. port



Converted American motorship Seekonk is fitted with electric auxiliaries. The winch is so located that the operator has a clear view of the loading and unloading work



Loading sulphur on to barge from a steamship in Erie Basin, Brooklyn

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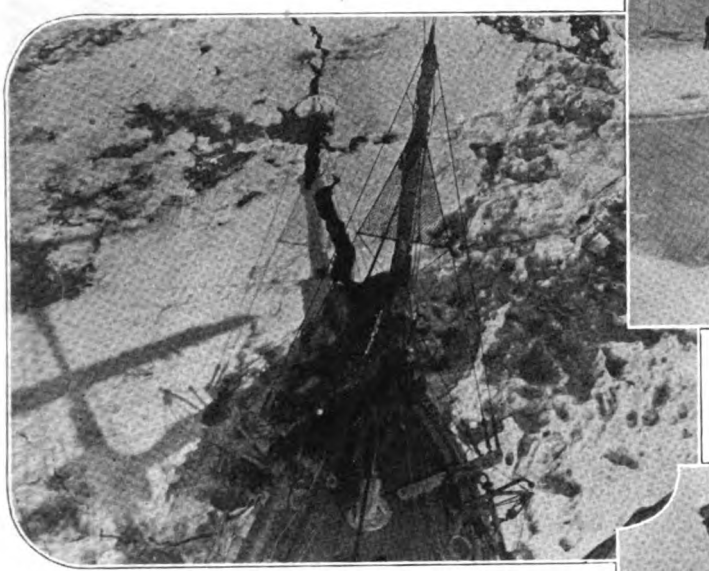
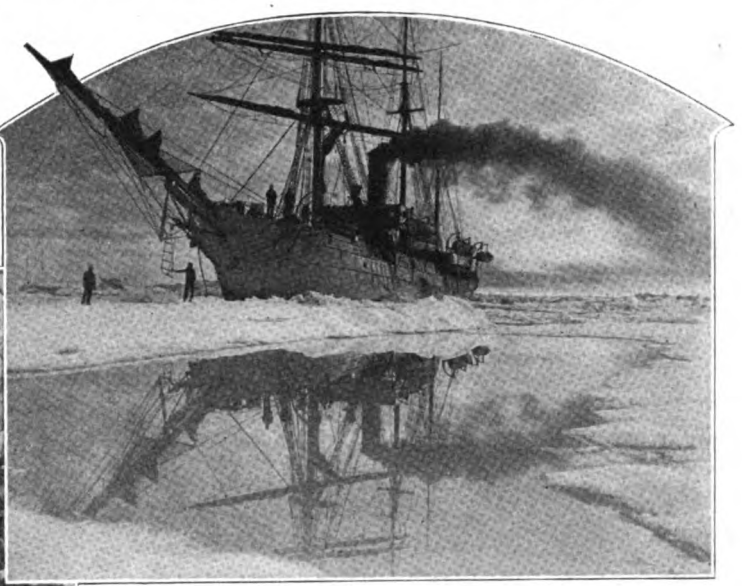
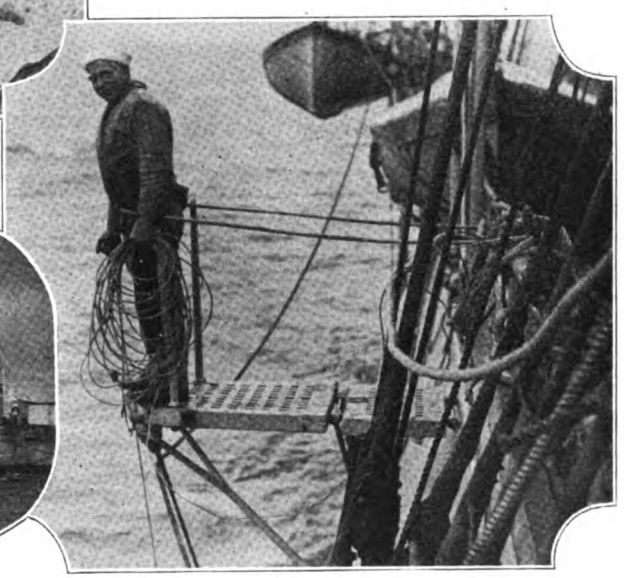
Latest Marine News in Pictures

Famous U. S. S. cutter Bear which has been bucking Arctic ice for many years. Below, crack in center shows efforts of the Bear to force her way through the loose pack

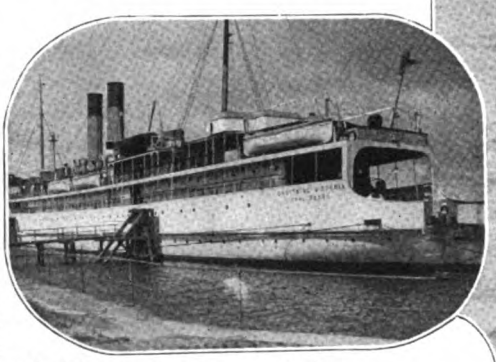




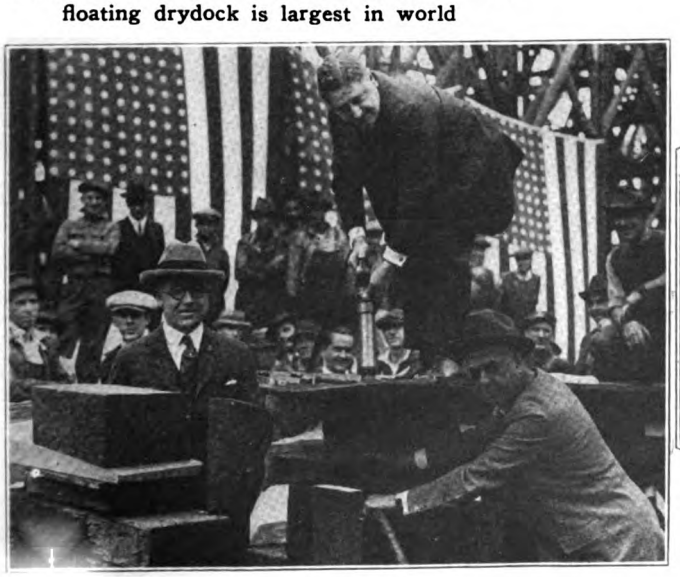
Sailor on U. S. S. Bear ready to take a sounding in the Arctic ocean

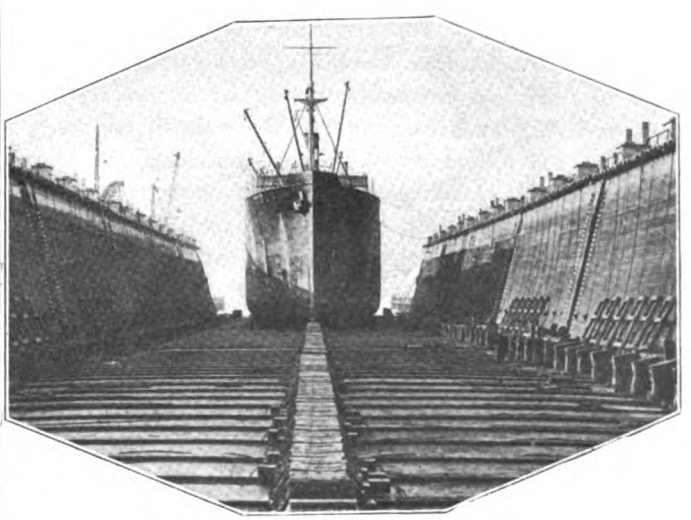


One of fleet of big train ferries from Sassnitz, Germany, to Trelleborg, Sweden



Wm. Wrigley Jr., driving rivet for his liner building at Los Angeles. Chairman Baker, of shipyard is holder-on. At right, Edith, a big ship looks lost in drydock at Brooklyn plant of Morse company. This floating drydock is largest in world





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Editorial

Two Old Ships and Their History

SHIPS have histories which color with the hue of romance. Other handiwork of men, buildings, hotels, railroad cars, all of which performs services similar to ships, fail to combine the qualities of usefulness and adventure. The low rate of steamship values and earnings in the past year or two has had one result in hurrying to the scrap pile the most uneconomical vessels and in promoting the sale of old but still serviceable ships to other nations where costs of operation are lower, making new ships unnecessary.

One typical instance of each kind, shows why a ship is something more than a prosaic vehicle of trade. The ship in one way or another serves as a focal point where national, commercial and human needs meet. As sketched below, the MINNESOTA carried with her the ambitions of a railroad wizard and his plan for winning the best of transpacific trade. Although she failed in these two purposes, the MINNESOTA paid back to the nation many times her cost by her contribution to troop transportation and freight carriage during the war.

The other ship, the foreign built RUSSIA, was a trade weapon in the hands of Russia against Germany, she made her large contributions to America when the melting pot theory was still popular, had a touch of Bolshevik control, of German prisoners on board, and finally goes now to Japanese owners. How much more interest would attach to the Woolworth building if it could claim such a colorful record of adventure.

Holder of the title of the world's largest cargo carrier since 1905, the MINNESOTA is finally being dismantled in a German yard for the scrap value of her metal. While her career shows a fairly steady train of unfortunate or unsuccessful events, she more than justified her construction by the work she did during the war. James J. Hill, head of the Great Northern railroad, built her and the DAKOTA in an Atlantic yard constructed especially to fill this one contract. They were to extend the freight lines of the Hill railroad system across the Pacific, as the Canadian Pacific was successfully doing. Their tremendous deadweight capacity of 28,000 tons and passenger accommodations for nearly 3000 was offset by a slow speed of only 14 knots. The DAKOTA was wrecked near Japan. The MINNESOTA in 1911 broke both propellers 1700 miles from Yokohama but her engineers contrived to repair one sufficiently well to let her crawl back to Japan under own power. In 1915 she stranded in Japan's inland sea and had to be released by dynamiting. In 1916, the International Mercantile Marine Co. bought her for Atlantic work. She was successful in the days of high freights and especially after the United States entered the war and she began to carry large numbers of troops in her roomy quarters. After the war, she was successful at first in the steerage trade but immigration restrictions removed the best prospects from that service and she was too slow and expensive to be economical. A few months ago, German ship breakers bought her. Enroute she stranded on the Dutch coast but was quickly released. She had an interesting if not particularly successful career.

The RUSSIA was built in the United Kingdom in 1908, with 8600 tons and 16-knot speed. The Russian American line wanted to run her between Libau and New York in competition for the Russian emigrant trade with German ships. She was fairly successful despite the strong German competition. One assertion is that her agents advertised "travel by our Russian steamer, and do not be forced to take a bath." She spent more than six months of 1911 resting on a rock near Libau, as salvage proved a long job but was successfully and creditably performed. Her repairs ran up close to $300,000. She slipped past the Germans in the Baltic during the first days of August, 1924, and was at Cronstadt, Russia, during the war. After the czar's overthrow, she was renamed ROOSIJA, in response to the awakened national spirit. Great Britain took her after the armistice to carry prisoners of war to and from Germany and in 1919 returned her to the East Asiatic Co., Copenhagen, her real owner from the beginning. In charge of this experienced Danish firm, she ran first to South America where on one trip she was badly damaged by fire in the River Plate. She was laid up for some months and then came out in May, 1921, to run as the LATVIA between Dantzig and New York. American immigration restrictions cut into the trade but she did fairly well, for one thing bringing back to this country on one trip, about 1000 Americans who had been fighting for Poland. She was laid up in March, 1923 and now has been sold to the Japanese.

Congress may use up quite a little energy during the present session in activities affecting the marine industry. But the chances are that instead of working out legislation of value such as acting on the suggested revision of navigation laws, analyzing the question of discriminating duties and taking steps to hasten the disappearance of the government from the shipping business, congress will play politics. Until the presidential election, politics have the stage, national welfare can wait outside. The question of investigating the shipping board and finding out for one thing why it has not sold more ships and cut down its expenses in other ways, will be determined not by expected results but by politics. The hearings on oil leases have embroiled men in both parties to a degree which may make the politicians shy away from another investigation. The motto will be "make political ammunition while the ships rust."

Government officials, once given a taste of running a business, dislike letting go. Australia has had its own fling at government ship building and ship operation, and like this country has spent huge sums of money with little to show in return. Recently, the officials have been selling off some of their fleet but they shy at the thought of really quitting. They have decided to keep their best ships and operate them in the most likely looking services.

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Two More Big Freighters Ordered on Lakes

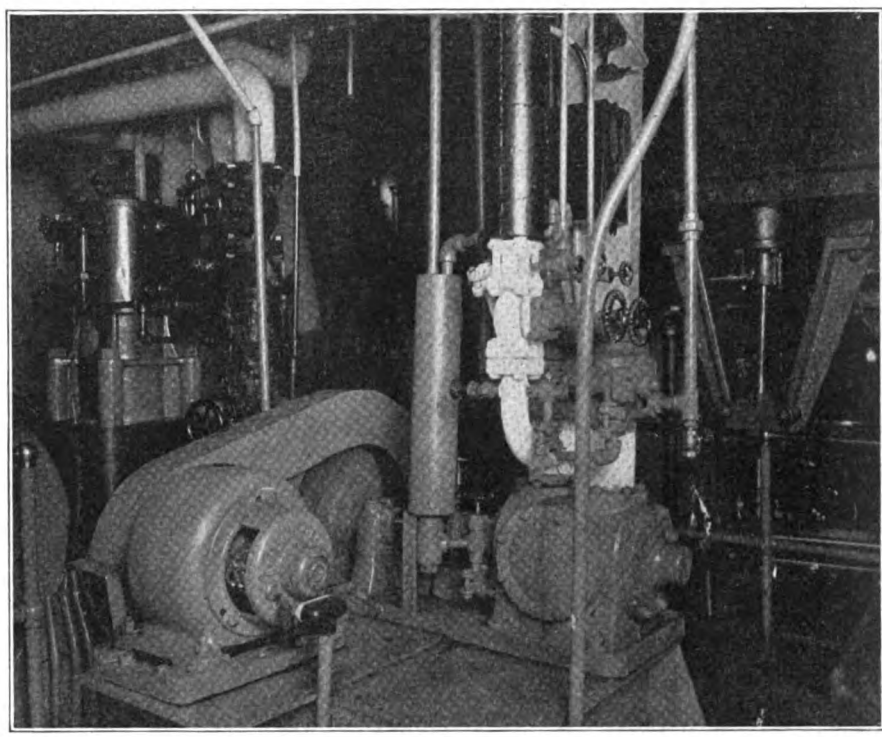
A 550-foot bulk freighter for lake service was ordered in January by the Mathews Steamship Co., Toronto, Ont., from the Collingwood Shipbuilding Co, Collingwood, Ont. The beam will be 58 feet and the molded depth 31 feet. Delivery is now planned for September.

This contract was drawn at about the same time as one for a bulk freighter 612 feet in length over all given by Herbert K. Oakes, manager, the Franklin Steamship Co., Cleveland, to the Great Lakes Engineering Works, Detroit. This vessel is a duplicate in size of the two new Ford vessels, with a keel of 586 feet, beam 62 feet and depth 32 feet. Reciprocating engine of the triple expansion type with Scotch boilers will furnish the power. With the WILLIAM K. FIELD, launched by the Toledo Shipbuilding Co., Toledo, O., late in January, six big bulk freighters are now under contract for 1924 delivery.

Ice Machine Proves Success on Lakes

CHANGED conditions of service bring the need for altered ship's equipment. An important instance of this kind is found on the Great Lakes where questions of pure water and refrigeration have only become important to the shipowner in the past few years. Previously, the lakes themselves furnished a reservoir of pure water and the tanks were easily and quickly filled. The zone of pure water, originally including all the lakes, was gradually restricted to the center of Lake Huron and Lake Superior. A few years ago government inspectors insisted on this practice being dropped. Now lake vessels fill their tanks with approved water from city mains or carry water purifiers.

Refrigeration has taken on similar new importance. The standard of galley service on lake ships has always been high while the relatively short trips and the contact at the Soo canal with supply boats midway of each trip delayed the installation of refrigerating equipment. But the installations which were made proved themselves, insuring better control of the purity of the food supply and thus saving food, avoiding any lost time waiting for ice deliveries and making refrigeration assured at all times. As a result of these demonstrations, lake vessels are being more freely outfitted with refrigerating machines and practically all new boats are thus equipped.

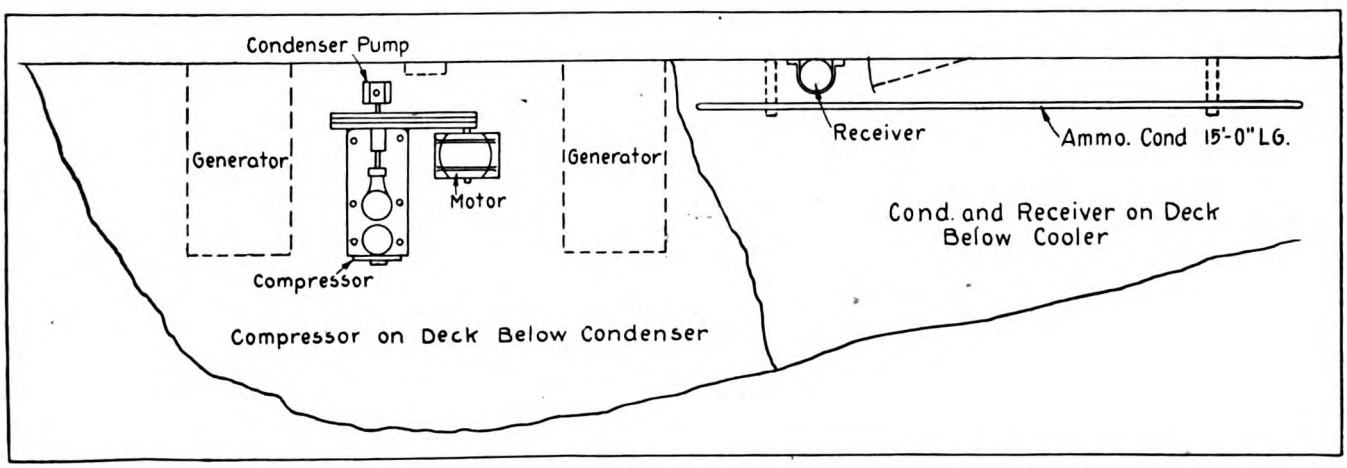


ELECTRIC ICE MACHINE ON LAKE FREIGHTER THOMAS WALTERS

A company which has specialized in refrigeration is the Phoenix Ice Machine Co., Cleveland. The following description traces the main features of its product and includes views of a typical Great Lakes installation. The plant illustrated was installed on the THOMAS WALTERS of the Interstate Steamship Co., Cleveland, and has operated successfully.

Most of the Great Lakes vessels are not equipped with refrigerating machinery and those that are, mainly

(*Concluded on Page* 117)



LOCATION PLAN OF ICE MACHINE INSTALLATION ON GREAT LAKES FREIGHTER

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Plan New Diesel for Big Output

Eastern Engineers Design Engine for Manufacture Along Modern Standardized Methods—First Engine in Service

IN THE November issue of MARINE REVIEW, views of the SUPHENCO and her main engine, a 2000 indicated horsepower, 6-cylinder, 4-cycle, crosshead diesel type, and a short description of her conversion from a steamship and performance on her initial voyage, were published. Now additional detailed photographs and descriptive information on this interesting installation have been received.

The SUPHENCO shown in Fig. 4, represents a large bloc of ships, 150 in all, built during and after the war, of the following general dimensions:

Length, over all, ft. in.	335 6
Length, bet. perps., ft. in.	324 0
Breadth, molded, ft. in.	46 0
Depth, molded at sides, ft. in.	28 6
Gross tonnage	3545
Net tonnage	2174
Deadweight tonnage	5350

This further record of the conversion to diesel drive with electrically driven auxiliaries of one ship of this type, is interesting and informative in view of the possibility of additional conversions.

Main Engine

The builder and owner of the SUPHENCO, the Submarine Boat Corp., having applied with success the principles of standardization to the construction of 150 ships at its Newark Bay plant and in building many submarine chasers and having contact with the building of diesel engines through one of its subsidiaries, decided to apply principles of simplification and fabrication to the plans for the diesel engine to be installed in this ship. In this way, it was deliberately planned to avoid a massive complicated unit composed of huge castings, inaccessible parts and a great number of small and dissimilar items. By keeping in mind these cardinal points in the detailed design of all the parts, the engineers sought to give each part the advantages of interchangeability, to permit the engine as a whole to be built in any multiple and to provide for the parts going through in quantity as distinct from the individually built engines with constant changes in the design of parts. Of course, this sort of standardization can not be definitely settled upon until service as well as theory has demonstrated perfection in design. With these underlying principles in mind the design and construction of the diesel engine for the SUPHENCO was entrusted to the James Craig Engine Works, Jersey City, N. J. Two years were required to build the engine which is indicative of the policy in this case to make haste slowly, in order to insure mechanical perfection throughout. After being fully assembled in the shop, the engine was taken apart and shipped to the Newark Bay shipyard for final installation in the ship.

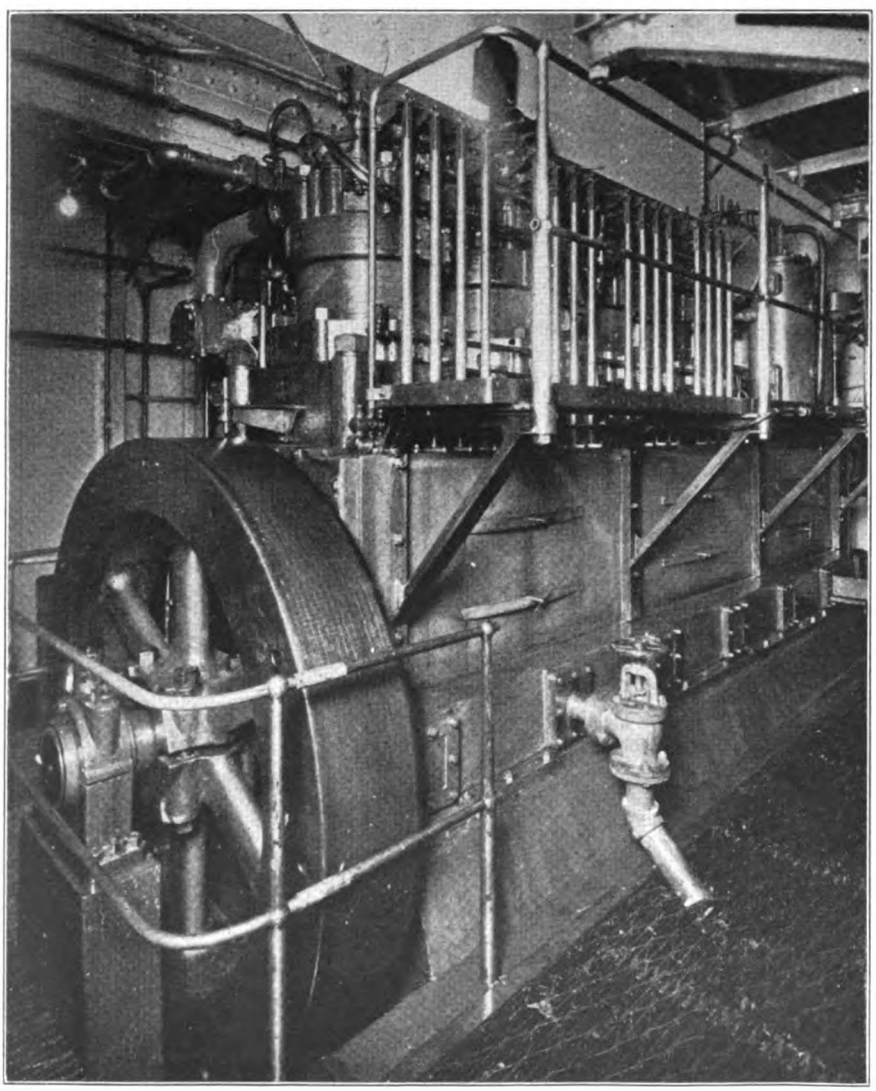

FIG. 1—LOOKING FORWARD AT 250-HORSEPOWER MAIN COMPRESSOR

Description of Engine

The engine is a 6-cylinder, 4-cycle, crosshead type diesel developing 2000 indicated horsepower at a maximum of 100 revolutions per minute with a 30-inch bore and 48-inch stroke. An unusual feature of the design makes possible the assembly of the engine as either a right hand or left hand engine without extra work or fitting. Some of the weights are interesting. The bed plate cast in two sections weighs 64 tons and this tremendous mass effectively absorbs the vibration, the crankshaft weighs 52 tons and the six cylinders total 30 tons. Each cylinder table weighs 15 tons and the flywheel weighs 15 tons.

There is no attached air compressor, the fuel air being injected by an auxiliary unit of ample capacity for the severest conditions of maneuvering ahead and astern. This was demonstrated, according to the owners, on the ship's initial voyage, tug services not being necessary for handling the ship in and out of her loading berths. The engine starts on air, is directly reversible and has a lower air intake and exhaust in addition to the customary upper exhaust and air intake.

The cylinders are supported on steel columns with suitable diagonal bracing.

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Below the cylinders all moving parts are enclosed. Removable doors furnish access for observation and overhaul. A feature on which great stress is laid is the accessibility to all parts. The operating controls are located in the center and at a height so that they can be operated from the upper platform, an improvement over the old style, located below. Driving gears for the camshaft are located at the center of the engine under the operating platform. In the design of the engine throughout, the arrangement has been carefully studied to make possible reaching all parts readily without dismantling when minor repairs are necessary.

Auxiliaries Driven Electrically

Water cooling is applied to the main bearings, crankshaft and the pistons by means of telescopic pipe connections. Separate sets of cams are mounted on the camshaft, one set for going ahead, and one set for going astern. The camshaft is moved in a fore and aft direction for reversing the engine by bringing into action the opposite set of cams. An interesting flywheel turning device has been worked out as a special feature in the construction of this engine. A 7½-horsepower motor mounted on the steel columns above the flywheel is employed through a suitable worm drive, for turning the flywheel.

Air for starting and injection for the main engine is furnished independently by means of an auxiliary diesel engine driven compressor. This main compressor, shown in Fig. 1, is driven by a 4-cycle, 4-cylinder diesel engine of 16-inch bore and 18-inch stroke, developing 250 indicated horsepower at a maximum of 250 revolutions per minute. Two 85-kilowatt generators direct-connected to 4-cycle, 2-cylinder diesel engines of 16-inch bore and 18-inch stroke developing 120 indicated horsepower at 250 revolutions per minute, furnish the electrical power for driving all of the ships' auxiliaries. Fig. 2 shows one of these generators. Both of these main generating sets are also equipped with compressors and thus serve as an emergency source of air for operating the main engine, at reduced power should the principal compressor unit (Fig. 1) need overhauling while at sea. Fig. 3 shows an auxiliary unit consisting of a 4-cylinder, 4-cycle, 5 x 6-inch gasoline engine operating at 600 revolutions per minute equipped with a compressor and direct-connected to a 10-kilowatt generator. This unit will supply the initial compressed air supply in the bottles for starting operation and also serves for lighting purposes when in port. The auxiliary diesels and gasoline engine described above were designed and built by the James Craig Engine Works, Jersey City, and the

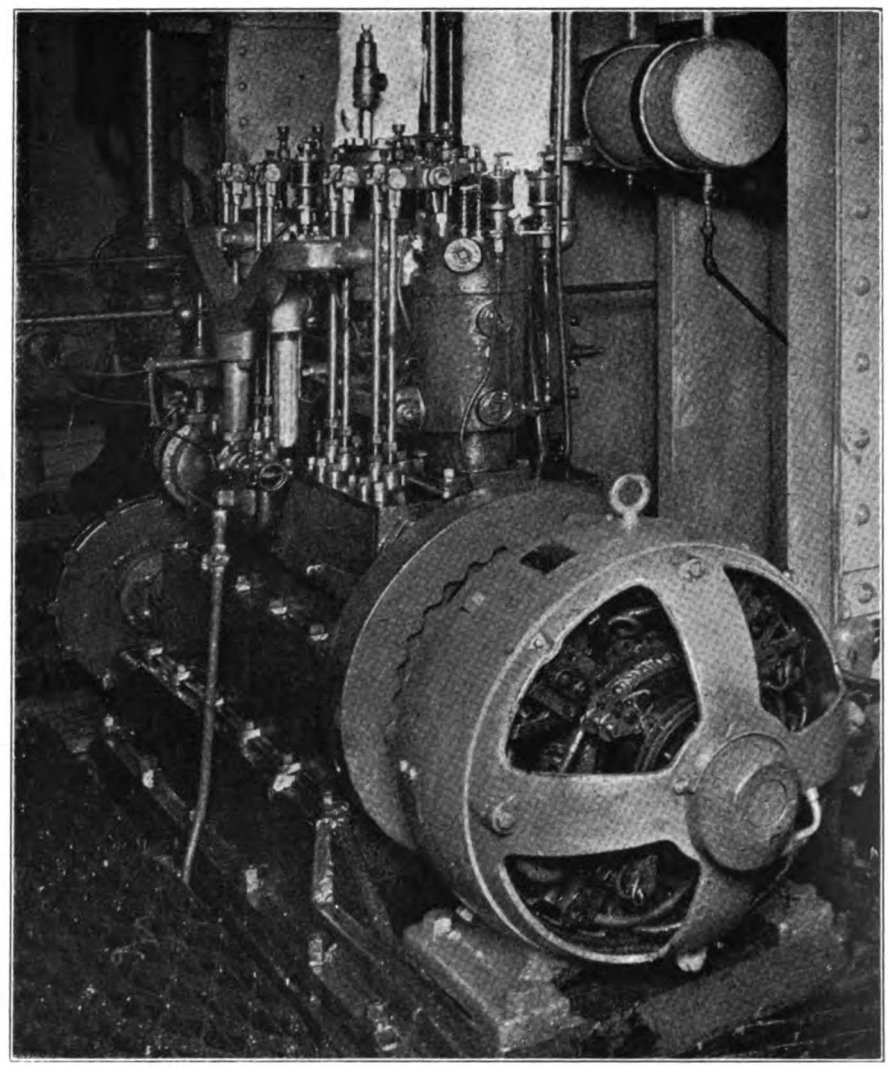

FIG. 3—GASOLINE DRIVEN AUXILIARY DIRECT-CONNECTED TO 10-KILOWATT GENERATOR

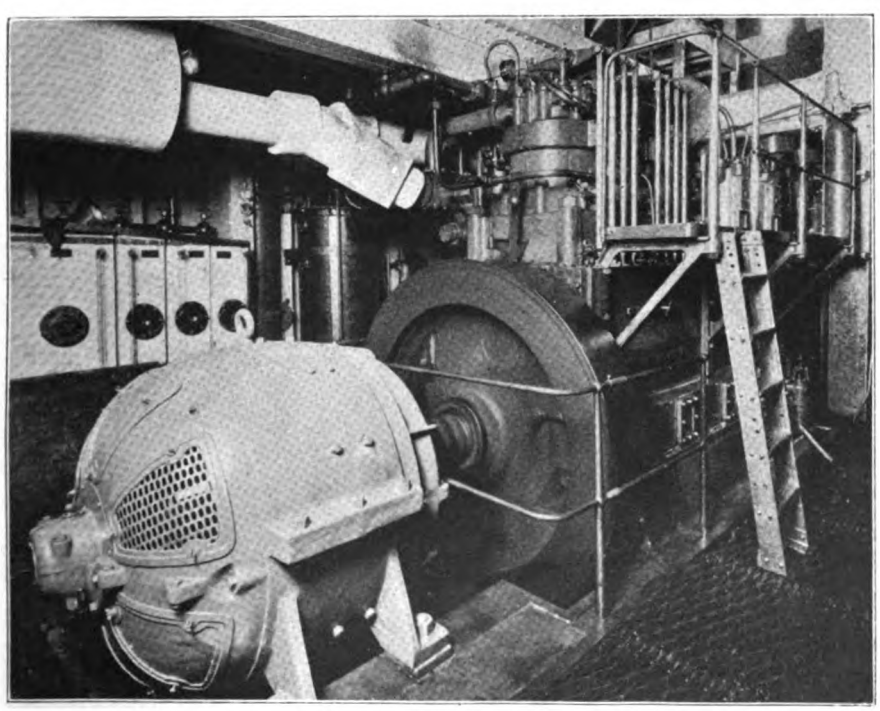

FIG. 2—LOOKING AFT AT 85-KILOWATT GENERATOR

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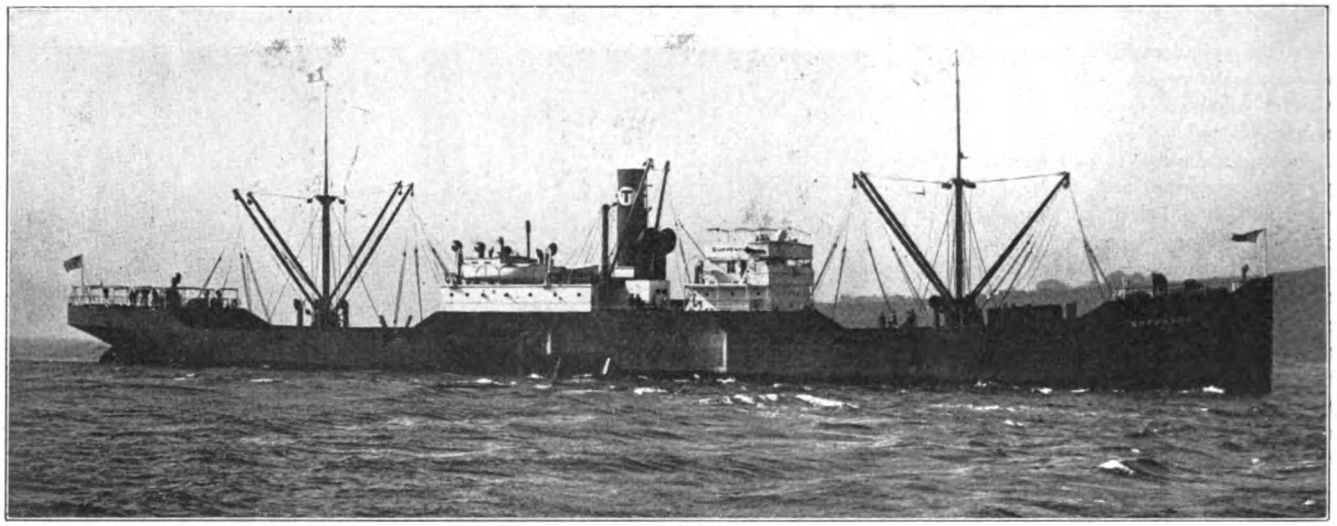

FIG. 4—MOTORSHIP SUPHENCO, 5350 DEADWEIGHT TONS CAPACITY, OPERATING IN THE GULF SERVICE

electrical generators by the Electro Dynamic Co., Bayonne, N. J.

The pumps include:

Two 6-inch centrifugal jacket water circulating pumps;

One 6 x 12-inch horizontal duplex double acting fire and bilge pump;

One 10 x 12-inch horizontal duplex double acting ballast pump;

One 5 x 6-inch horizontal duplex double acting fuel oil transfer pump;

One 2½-inch centrifugal sanitary pump;

One 1-inch centrifugal scuttle butt pump;

One 1-inch centrifugal fresh water pump;

One 1¼-inch gear driven Rumsey pump for lubricating oil;

One 1¼-inch gear driven Rumsey pump for draining settling tanks.

Fig. 5 shows the 10 x 12-inch motor driven horizontal duplex double acting ballast pump. All of these pumps were supplied by the Worthington Pump & Machinery Corp. and are electrically driven by motors supplied by the Electro Dynamic Co. Additional pump equipment consists of three Gould's double acting hand pumps for use as fire pumps and emergency fuel oil transfer and lubricating oil pumps.

Additional equipment includes one 1-ton Brunswick-Kroeschell refrigerating machine, motor driven, operating a direct expansion ammonia system; one De Laval centrifugal oil purifier and one donkey boiler, oil-fired of Lidgerwood Co.'s manufacture, for heating the fuel oil and for supplying steam heat for the sanitary system and quarters.

The deck machinery includes 10 motor driven Lidgerwood winches; 1 motor driven capstan; 1 motor driven windlass and 1 motor driven steering engine. The capstan, windlass and steering engine were all supplied by the American Engineering Co., Philadelphia. All the electric motors are of Electro Dynamic Co.'s make and all electric controls for steering engine winches and throughout the ship were designed and constructed by the Cutler-Hammer Mfg. Co., Milwaukee.

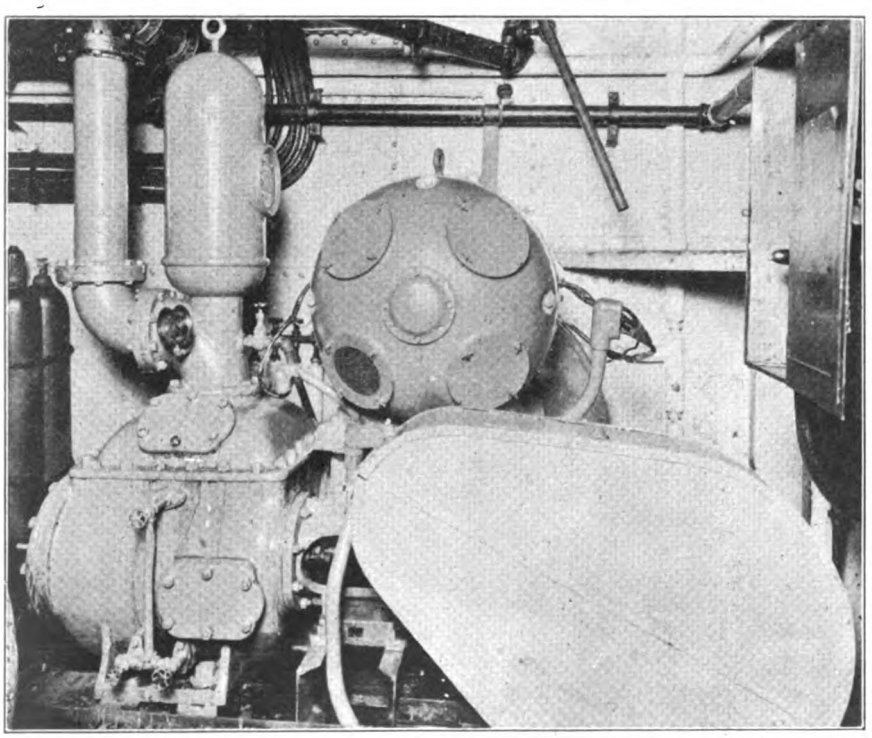

FIG. 5—LOOKING AFT AT 10 X 12-INCH DUPLEX, DOUBLE-ACTING BALLAST PUMP DRIVEN BY 25-HORSEPOWER MOTOR

Breaks Record for Long Distance Radio

The American freighter WEST NILUS when 95 miles north of Wellington, New Zealand, on Dec. 16 picked up radio messages from the Chatham, Mass., station of the Radio Corp. of America. The distance is 9300 miles and sets a long distance record for commercial 600 meter continuous wave transmission. The letter telling of the record took more than 50 days to reach this country.

Seventy-five days from the Columbia river, the American ship REUCE recently arrived at Nogoya, Japan, with a cargo of lumber and logs. This may be the REUCE'S last deep sea voyage as it is likely she will be sold in the Orient. The REUCE is one of the few remaining ships built at Atlantic yards and still in service. She was launched in 1881 at Kennebunk, Me.

Arrangements have been completed by the Boston Pilots' association for the construction of a new pilot boat to replace the LOUISE (No. 2). The new schooner is being built at the yard of James & Son's, Essex, Mass., and will be launched next fall.

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Name D. V. Stratton Head of Drydock Company

George C. Clarke has resigned as president of the New York Harbor Dry Dock Co., Inc., New York, due to the demands of his other business interests. D. V. Stratton succeeds him as president. He has had an extended experience in marine construction and repair work. Following a number of years of contact with general marine and dredging operations, he was chosen during the war to organize a number of large steel-building yards for production.

Following the ship construction period, Mr. Stratton went to Europe to assist J. E. Sheedy, vice president of the Emergency Fleet corporation in the reorganization of the forces of the shipping board in Europe. During this time, Mr. Stratton made a study of the problem of ship maintenance and operation in the various European shipping countries. During the course of this work, he visited all of the principal building and repair plants of Europe with a view of comparing them from the standpoint of equipment, organization and control methods, with the plants of the United States. The future tendencies in ship design and construction, particularly with reference to diesel drive, were made a special and careful study. Upon his return to the United States, he entered the organization of the Morse Drydock & Repair Co., Brooklyn, in charge of business development, a connection he now resigns.

Ice Machine Proves Success on Lakes

(*Concluded from Page* 113)

have steam driven equipment. But as in all other lines of engineering, rapid strides are being made in refrigeration, and electricity today has assumed a leading position as the practical power to be applied to the operation of an ice machine.

Engineers of the Phoenix Ice Machine Co., Cleveland, have made a careful study of marine requirements with a view to overcoming any objection to ammonia systems, stuffing box troubles, need for manual labor to operate plant and improper cooler design.

Criticism of the use of ammonia on vessels has frequently come from lack of knowledge. Ammonia piping when properly installed by competent mechanics is not nearly as dangerous as steam or gas can be. The low side piping of an ammonia plant operates at a maximum pressure of 30 pounds while the high side seldom reaches 200 pounds. Every part of the system is tested out to 300 pounds pressure before being charged with ammonia.

Every possible safety device of merit is used on the machine and auxiliary equipment throughout. The compressor has a safety relief valve on the discharge side which opens at 250 pounds pressure and is by-passed into the suction side which prevents possible chance of blowing a cylinder head out. Between the compressor and oil trap, a by-pass check valve is placed to prevent a possible escape of ammonia in case of a bad

D. V. STRATTON
Newly elected president of the New York Harbor Dry Dock Co., Inc.

break in the piping between these parts. On the ammonia receiver, a safety relief valve is placed which is piped to outside atmosphere through a diffuser when the safety valve lets go.

The ammonia compressor illustrated is of the company's latest design. It incorporates some new features. C. L. Steglich, chief engineer and designer of the Phoenix company, has had considerable experience in ice machine design, having served at various navy yards.

Accessibility to make repairs is of the utmost importance on ship equipment. The cylinders of these compressors are separate from the crankcase and are easily taken off, bored and replaced. A large manhole cover on the crankcase gives ample room to make adjustments to the bearings. The connecting rods are constructed so as to take up the wear without losing the efficiency of the compressor.

The stuffing box is the outstanding feature of the compressor. Every engineer knows that stuffing boxes on ice machines are trouble makers, because they will become hot or cold intermittently. When too cold, they leak and if tightened up too tight the packing will burn. The Phoenix engineers state that this difficulty has been entirely overcome. The stuffing boxes are so designed that the packing has ample room for expansion and contraction while a special compression system keeps the stuffing box jammed with grease to prevent leakage of ammonia as well as to insure long life without adjustments.

The flywheel of the compressor is a part of the chain drive. It is cut the same pitch as the chain and motor pinion. The pillow block bearing is ring oiling like a motor.

All new equipment developed for ships means another piece of machinery for the engineer to look after. This is nearly overcome in ice machine electrically operated by thermostatic control since only a minimum amount of attention is needed. The motor-driven ice machine is located on one of the decks below the refrigerator. This machine is so equipped with special electrical devices that it will start and stop as the temperature of the cooler varies and affects the room thermostat which is set for the proper degree of coldness.

In some cases a water pump is connected on the same shaft of the ice machine for delivering water to the ammonia condenser. A 3-horsepower motor operates a 1½-ton compressor.

Receives Big Order for Condenser Tubes

The American Brass Co., Waterbury, Conn., was recently awarded a contract for 750,000 pounds of admiralty condenser tubes by the Shipping Board Emergency Fleet corporation. The order came immediately after the company had completed shipments to the same buyer of 250,000 lengths of condenser tubes weighing 1,100,000 pounds.

Since it operates the largest number of vessels controlled by any one American shipping concern, the shipping board is the largest buyer of condenser tubes in this country. The specifications under which these tubes are manufactured and which govern the selection of all condenser tubes for shipping board vessels, are exacting.

The board of harbor commissioners announce the construction this year at Vancouver, B. C., of a coal shipping terminal to cost $500,000.

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Business News for the Marine Trade

Elder & Mittnacht have been incorporated at Wilmington, Del., with $100,000 capital to operate steamboats.

Barge Canal Dry Dock, Buffalo, has been incorporated for $25,000 to deal in realty and engage in shipbuilding, by B. L. Cowles and J. E. Matton, with J. A. Stone, Buffalo, as attorney.

Shipyards, Inc., San Diego, Cal., has been incorporated for $50,000 to own and operate shipyards.

Central American Shipping & Trading Co., Dover, Del., has been incorporated for $100,000 to operate ships and handle foreign commerce, etc.

Great Lakes Dredge & Dock Co., Cleveland, has awarded construction of two steel tugs to the Manitowoc Shipbuilding Corp., Manitowoc, Wis. The tugs will be 85 feet long, 21 feet beam and 11 feet deep.

Association Dredging Co., Philadelphia, has been incorporated for $100,000 to operate dredges and other similar equipment.

New London Ship & Engine Co. of Delaware has increased its capital stock from $100,000 to $6,000,000.

Murray & McCourt, New York, has been incorporated for $10,000 to own and operate boats, by William J. Martin, William A. Knight and Charles P. Schroetter, with F. L. Mettler, Wilmington, Del., as attorney.

Capital Steamship Corp., New York, has been incorporated for $10,000 to act as ship broker, by J. L. Delius, A. Ross and H. N. Deyo, with Wingate & Cullen, 20 Nassau street, New York, as attorney.

Pontin Boat Corp. has been incorporated for $50,000 by Patrick J. Dobson, Charles P. Schroetter and Warren J. Eldridge, New York, with Franklin L. Mettler, Wilmington, Del., as attorney.

The Shelton Bros. Foundry Co., Paducah, Ky., plans 1-story foundry for manufacture of steamboat machinery. Extensions are to cost about $40,000.

Richardson Navigation Corp., New York, has been incorporated for $100,000 by A. Richardson, C. Treling and C. C. Harris.

New York Marine Co., Delaware, has named the secretary of state of New York as representative with 1000 shares of preferred stock, $100 par value, and 3000 shares no par value common stock, to handle lighterage business.

Dixie Harbor & Terminal Corp., Dover, Del., has been incorporated for $1,000,000 to build wharves, public and private works, etc.

Christenson Lumber Co. has acquired the San Francisco retail yard of the Olson & Mahony Lumber Co., Fifth and Channel streets, that city. The Christenson company is a subsidiary of Sudden & Christenson, lumber and shipping company.

W. L. Comyn & Co., San Francisco, has sold the steamer IDA to Japanese interests for about $130,000.

W. A. Blake & Co., Baltimore, operator of the Blake lines, has extended its operations to include a freight service from Boston to Manchester, England.

Atlantic Seattle Steamship Corp. of New York has been incorporated under the Delaware laws with a capital of $2000 to act as broker.

The General Engineering Co., San Francisco, secured the contract for voyage repairs on the PRESIDENT TAFT of the Pacific Mail line at $5291 and the contract for betterments and overhauling the refrigerating machinery of the vessel at $6751; for the installation of sea postoffices on the Pacific Mail liners, PRESIDENT CLEVELAND at $5601, the PRESIDENT LINCOLN at $5480 and the PRESIDENT WILSON at $5489; for voyage repairs to the steamer WEST SEQUANA at $1113.

The Reed Propeller Co., New York, has been incorporated with a capital of $200,000 by S. A. and L. G. Reed and W. Fowler, with F. Knorf, Albany, N. Y., as attorney.

Suffolk-Baltimore Steamship Co. has been incorporated for $20,000 at Suffolk, Va., with D. K. Joyner as president and I. B. Powell as secretary. The company will operate a boat line between Suffolk and Baltimore.

Johnson Motor Products, Inc., 518-2 West Fifty-seventh street, New York, has been incorporated to make marine motors. Plants are owned and leased in New York and Eddystone, Pa. H. A. Johnson is president.

Emergency Fleet Corp. has sold six ex-enemy vessels to the Boston Metal & Iron Co., Baltimore, to be scrapped. Vessels are the AMPHION, ASCUTNEY, MERCURY, NANSEMOND and VON STEUBEN

American Transport Corp. has been chartered under the laws of Delaware with $25,000 capital to own and operate steamers, by George W. Sterling, president; Thomas Eckert, vice president; Addison Atwater, secretary, and W. S. Silver, treasurer.

W. & A. Fletcher Co., Hoboken, N. J., has been awarded contract for reconditioning the NORTHLAND for the Eastern Steamship Co. at an expense of about $175,000 for the improvements.

Pawnee Corp., Delaware corporation, has appointed the secretary of state of New York as representative in that state. Company has capitalization of 1000 shares no par value.

The Los Angeles Shipbuilding & Drydock Corp., Los Angeles, secured the contract for reconditioning the CITY OF LOS ANGELES at $635,000. All engine and auxiliary equipment is being torn out and watertube boilers and new turbines will be installed.

The board of harbor commissioners at San Francisco are planning a new lumber terminal on Islais creek which, when completed, will give San Francisco the most modern lumber handling facilities on the Pacific coast. Lumber experts believe the port is losing a fair percentage of the lumber because the present hand method is too slow and expensive. It is proposed to install derricks, cranes and other time saving devices at the new terminal instead of using an army of stevedores to handle the lumber one stick at a time.

San Francisco shipyards did more work in 1923 than in any yearly period since the war. Over $7,000,000 worth of ship repair and shipbuilding work was contracted for, of which more than $4,000,000 was secured by the Bethlehem Shipbuilding Corp. Construction of tank steamers for the Standard Oil Co., the Associated Oil Co. and the Union Oil Co. comprised the majority of the work done.

The Crowley Shipyards, San Francisco, secured the contract for voyage repairs on the freighter GLYMONT at $1850 and for general repairs on the steamer MURSA at $13,000.

The General Engineering Co., San Francisco, secured the contract for repairs on the United States army transport MEIGS at $3386.

The passenger service of the Merchants & Miners Transportation Co. between Boston and Philadelphia, which was suspended during the winter months, will be resumed March 1.

Business Changes

CLEVELAND offices of the Great Lakes Engineering Works, Detroit, are now at 1963 Union Trust building, Euclid avenue and East Ninth street. Formerly they were in the Rockefeller building. John T. Webster, vice president, is in charge.

* * *

J. T. SORGE, for the past four years attached to the inward freight department of the New York office of the Dollar line, has been promoted to commercial agent for the line at Boston.

* * *

WILLIAM H. PATRICK JR., Philadelphia, has been appointed traveling representative of the terminals operated by the Tidewater Terminal of that port. The new solicitor will operate around Pittsburgh, Buffalo, Boston and New York.

* * *

FREDERICK G. STOYLES, who has held the position of assistant to the freight traffic manager of the Cunard-Anchor lines at Boston, is now acting freight agent for New England, having succeeded to the position of FRANK K. BELL who was recently transferred to the New York office of the company.

* * *

W. E. MACGUCKIN has succeeded J. T. SOMERS as Boston manager of the Continental Cargo Checking Co. with offices at 113 State street.

* * *

C. H. Sprague & Son, Boston, have incorporated their business under the laws of Massachusetts and will operate as a corporation instead of a partnership.

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Kelvin & Wilfrid O. White Co., 112 State street, Boston, will become eastern agent for the Kolster radio compass. This compass, developed on the Pacific coast, has had numerous and successful trials on board ship, particularly on transpacific vessels.

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The Hazle Brook Coal Co., Stonega Coke & Coal Co. and the Wentz Co. have bought all of the stock of the General Coal Co. and are operating it under their management. The General Coal Co. will conduct the business formerly transacted by the Wentz Co. and will be the exclusive sales agent for three grades of coal and coke produced by the Stonega Coke & Coal Co. and for one grade of anthracite produced by the Hazle Brook Coal Co.

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